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The Electrical Outlook.

THE electrical industry has entered the New Year in the right spirit and with a right determination.

The fact that it has passed practically unharmed through a period in which industrial upheaval has crippled so many other branches of activity would alone justify high hopes as the nation settles down to more normal conditions. But in addition to that fact there are the inherent potentialities of electrical development of every kind, which are always opening out for it a new and ever-brightening prospect.

The right spirit alluded to is the sure and certain confidence that great times are at hand. Electrical men do well to indulge this thought and dwell upon the reasons and the signs in general conversation, though, of course, they will not allow a rosy prospect to lull them into contentment and repose. The determination mentioned is the general will to scheme and plan and labour to bring about that increased electrical turnover which will make the times great. Accelerated electrical development in all departments, bigger production, bigger sales, more employment, and bigger profits—these are things which should be, and we believe will be, witnessed during the year 1927.

For reasons which are better known to our readers than to anybody else, because we have so often alluded to them in recent times, there should be record orders placed for plant, cables, switchgear and apparatus, telephone and wireless equipment, and very large sales of all classes of appliances for domestic and industrial service in the Home Market. Indeed, here there ought to be no looking back for years to come. There are many signs of a revival in our general industries which will call for electrical work and products, and the homes of England are demanding electrical service more than ever before. The improvement in the world position of affairs, too, is leading us into new export possibilities, so that the present satisfactory state of our electrical export trade as evidenced by the statistical returns, should not merely be maintained but substantially advanced.

In short, both at home and abroad there should be plenty to do. The larger orders booked during 1926, including a number of noteworthy ones secured quite recently, are likely to occupy some of the works for many months to come, while the atmosphere is just right for securing much new business in all sections of the electrical and allied industries. Yet there is no room for lack of vigilance in regard to foreign competition. British directors, councillors, and engineers who desire to see British electrical industry grow larger and more prosperous, and who wish to see the unemployment figures fall month by month, should continue to give reasonable preference to British products.

The Time for Domestic Advance.

THE attention of all who are interested in domestic electrification is directed to the article from the pen of Mr. Herbert H. Berry, published elsewhere in this issue. Everybody is agreed that the time is fully ripe for electricity to stride straightforward in the domestic field. Influences normal and abnormal have combined in recent months to prepare the way—public discussion of electricity supply matters, coal shortage and dearness, and the wide-spreading activities set in motion under the E.D.A.-E.L.M.A. campaign. In some places great practical results in the shape of business have been achieved both in new connections and in output of appliances. This new business will itself be a powerful force in bringing on to the mains more and more consumers, for every new user will help the electrical educational movement. The campaign wheels will increase their speed of revolution for several months to come; the innumerable circles will do invaluable work carrying the truth in various ways from their centre out to the circumference of their respective areas. But why should a time limit to the campaign be set? Why should it not go on in some form or other? This is surely the moment when such a question should be raised. Therefore, in printing Mr. Berry's views on "The Electric Market-Place of the Future," we invite our readers to discuss the subject both amongst themselves and in the pages of the ELECTRICAL REVIEW. The opinions expressed by the author have our endorsement, as we have on various occasions stressed the need for co-operation of all interests in bringing electrical applications and electrical apparatus effectively before the notice of the public by means of exhibitions, in the form of Electric Houses, electric showrooms, electric shop windows and shops, local and travelling exhibitions, &c., in which efforts all sections of the industry—manufacturers, electricity supply authorities, and installation contractors—would contribute their quota. There is plenty of room for improvement in respect of organisation and selling on the retailing side of the electrical trade. There is wasted effort by some concerns overlapping in their door-to-door sales canvassing; some areas are overworked adding needlessly to selling costs, while others are under-worked. Local individualistic displays are excellent when planned with specialised local knowledge, but they might be more profitably and successfully conducted, so far as the trade is concerned, if dates could be fixed in collaboration with a centralised body. An Electrical Exhibition Committee, comprising delegates from all sections interested, has been set up, with Mr. Berry as chairman. It will operate under the auspices of the E.D.A., and, in our opinion, contains great possibilities for securing impressive electrical demonstration without undue waste of money if only the rank and file will support their leaders. There is much to be done by the raising of the status of electric selling depôts or centres throughout the United Kingdom. The atmosphere and the time are both suitable for co-ordinated effort. We must facilitate the purchase of all electrical contrivances everywhere if we design to assist to our utmost the domestic electrification movement.

The Central Electricity Board.

THE difficulty in finding suitable *personnel* to form the Central Electricity Board, which we have foretold on several occasions, appears to be making itself felt somewhat acutely at headquarters. Rumours are rife in the daily Press regarding overtures alleged to have been made by the Minister of Transport to various prominent men, with what degree of authenticity we do not know; and on the other hand, suggestions have been put forward apparently with the object of affording inspiration to the Minister, whose lot at the moment can hardly be a happy one. The salary said to be offered to the chairman was £10,000 a year. That is equal to the pay of the Lord High Chancellor, and is more than any other Cabinet Minister receives from the State—yet it is by no means comparable with the actual income of such an outstanding man of affairs as the Prime Minister apparently had in mind a year ago; and taxation would reduce it by one-half. As we have said, if the right man is obtained for this post, his motive for accepting the appointment must necessarily be a higher one than the hope of gain, for he will certainly be a loser in a pecuniary sense.

What salaries will be offered to the other seven members of the Board we do not know, but at least they should be equal to those paid to the Electricity Commissioners, which totalled about £15,000 a year when all the five offices were filled (one is still vacant).

Amongst the names that have been mentioned in the daily Press in connection with the formation of the Board are those of Sir Herbert Blain, Major H. Richardson, O.B.E., M.C., Sir Reginald Blair, Sir Philip Dawson, M.P., and Lieut.-Col. Sir Mathew Wilson, D.S.O., M.P. (the last two, of course, being members of Parliament, are ineligible at the moment) All members of the Board must divest themselves of any interests that they may hold in electricity supply undertakings and electrical manufacturing concerns within three months, and must afterwards refrain from acquiring or holding any such interests; these considerations must weigh heavily with many otherwise eligible persons.

Our sympathies are with the Minister of Transport; we look forward with keen interest to the announcement of his solution to this exceedingly difficult problem, and earnestly hope that it may prove to be a happy selection.

Transatlantic Telephony.

THE recent announcement that the Post Office would shortly be in a position to commence a commercial service of wireless telephony across the Atlantic, from subscriber to subscriber, aroused the interest of the public to an exceptional degree—and justly so, for the feat is indeed an astounding achievement. Some months ago we were favoured with an opportunity to participate in a "trial run," when conversation was maintained over a period of several hours between London and New York, the speech being extremely clear and distinct; it then only remained to organise the system on a permanent basis and to make the necessary arrangements for a regular public service, which work has been so expeditiously performed that the service will be inaugurated to-day.

Great credit is due to the wireless branch of the Post Office Engineering Department, which has displayed not only technical ability of a very high order, but also a degree of enterprise which is not usually associated with a State undertaking. The design and construction of the Rugby station—the most powerful in the world, and the first long-distance station to be wholly dependent upon valves for the high-frequency current—was in itself a first-class engineering feat, and it has been worthily followed up by the later developments, which, moreover, are not likely to represent the limit of the Department's ambitions.

To say that ten or twenty years ago the accomplishment of Transatlantic wireless telephony would have been regarded as an idle dream would be an error, for Dr. J. A. Fleming, who invented the thermionic valve in 1904, predicted it in 1907, and repeated his forecast in 1914. Only by the development of his invention has the achievement been made possible, and to him, with his co-workers in this field—many of them of British nationality—a large share of the credit should be given. Like Alexander Graham Bell, he has been privileged to see his work brought to triumphant fruition within his own lifetime. It should also be stated that the original experiments were carried out by the Western Electric Co., Ltd., in conjunction with their associated companies, and were described in the ELECTRICAL REVIEW of January 19th, 1923. Since that date research has proceeded continuously, and great advances have been made; the Western Electric Company has manufactured and installed the bulk of the plant, and continues to collaborate with the Post Office.

Dry Batteries for Radio Purposes.

Some Impressions of a Visit to the Woolwich Works of Siemens Brothers & Co., Ltd.; their methods of manufacture, and the care bestowed upon the assembly and testing of component parts.

ESTABLISHED in 1858, Siemens Brothers & Co., Ltd., has grown to be one of the largest electrical undertakings of its kind, enjoying a world-wide reputation: its Woolwich factories cover an area of 27 acres, and normally employ 6,000 persons.

Large extensions have been carried out at the works, and we were privileged recently to visit the enlarged battery shops and, in particular, to witness the methods employed by the Company in manufacturing and testing dry-cell primary batteries for wireless purposes. The well-established reputation of Siemens batteries is backed by the fact that primary cells, both dry and wet, have formed an important and successful portion of the Company's manufactures for over 40 years, and the accompanying illustrations will indicate the spaciousness of the modern shops devoted to the production of dry batteries; they are well lighted, heated and ventilated, the arrangement of the electric lamps and fans being visible in fig. 1.

Fig. 1.—Principal Dry-battery Assembly Shop: Side Bays just Visible.

The Company's dry cell (originally known as the "Obach" type) is considered to be one of the most satisfactory on the market, being made in both the square and round forms. The chief component materials are made up as follows.

Retort carbon is ground, sifted, and mixed with tar and certain other ingredients, which permit the electrode to be suitably shaped (rod, plate, &c., according to type of cell) in hydraulic presses. After trimming off the superfluous material, the electrodes are placed in drying ovens and then baked, maybe for several days in the case of the larger sizes, in order to burn out the mixing ingredients; the resistance is, of course, ascertained by means of a Wheatstone bridge method before the carbons are placed in store.

The other electrode is made of sheet zinc, which is cut up to size and pressed and soldered to shape; the canisters thus formed are next tested for mechanical strength, and also by means of compressed air under water to detect leaky specimens, being dried, of course, before amalgamation. Other types are drawn, which process eliminates joints, but necessitates the use of very pure zinc. Another kind of zinc electrode is cast, the mercury amalgam being incorporated in the molten metal; the mixing process is critical on account of the mercury being very volatile. The Company makes a point of amalgamating all dry-cell zinc electrodes, and to prevent the mercury attacking the solder, a bitumen compound is poured down the inside joint and allowed to flow round the bottom.

When a simple element is allowed to generate a current, the chemical action evolves gas, some of which adheres to the electrodes and produces an e.m.f. which opposes that of the cell, diminishing the latter. This polarisation, due to the products of the electrolysis which takes place, may be almost eliminated if the altered condition of the electrolyte, or plates, which causes it is removed as quickly as it is produced; thus the lowering of the e.m.f. due to this cause may be made very slight, or transient, though the e.m.f. is permanently lowered as current is generated by the "exhaustion" of the cell. In practice, only polarisation at the electro-negative pole is of importance, and the polarising ion is generally hydrogen; in order to overcome its action, the two electrodes are separated by a depolarising agent. The latter, in the case of dry batteries, consists of a stiff paste containing manganese peroxide and carbon, some plumbago to reduce its internal resistance, and gum; its exact composition is not disclosed by makers, but is regulated by cost, service requirements, and skill in manufacture.

Fig. 2.—Assembly of Standard "RB3" Batteries.

Assembling a dry cell (fig. 1) consists in tamping the

depolariser in a mould round a dummy core, the whole being then placed centrally into the zinc vessel, which also serves as the positive plate of the cell; the inside of the bottom of the vessel is coated with a bituminous compound on which a thick paper disk is laid, thus reducing the possibility of internal short circuiting. The space between the zinc canister and depolariser is filled by pouring in a thin exciting paste consisting of a solution of sal-ammoniac, flour, and plaster-of-paris, the latter causing it to set fairly rapidly. The dummy core is next removed, and the carbon electrode inserted in the centre hole, having been previously fitted with a tinned brass soldering cap, brass screw terminal, or plug socket. A little compound is poured over the top to ensure that no electrolyte will creep across and bridge the electrodes; then the cell is filled up with seed husks, which allow for expansion, and covered with a paper disk through which two small glass ventilating tubes protrude in the case of large cells: the cell is finally sealed with pitch. The above-mentioned precautions are taken to allow a ready means of escape for the gases generated in the cell, and so prevent the outer case "bursting," due to the gradual expansion which seems to accompany the drying of the paste.

At this stage the cells have the appearance indicated in fig. 5, which illustrates the three standard sizes. Each complete cell is now tested individually, first, for e.m.f. and then for p.d. with one ohm resistance in shunt with the voltmeter, which readings enable the internal resistance of the cell to be determined; Siemens voltmeters, having a very small current consumption, are used.

Considerable misapprehension appears to exist regarding the correct method of testing a "high-voltage" dry battery intended for use with radio apparatus. A high-resistance moving-coil voltmeter is, of course, the only suitable instrument for the purpose: the internal resistance of a battery increases with age and use, but it is of relatively little importance in view of the high internal resistance of a thermionic valve, *i.e.*, from 8,000 to 30,000 ohms or more: therefore, a battery having a high internal resistance may nevertheless be still capable of furnishing the maximum current required to operate radio receiving apparatus, provided its overall voltage is sufficiently high. Even a high-grade moving-coil voltmeter with a resistance of at least 100 ohms per volt of scale will take a current of 10 milliamperes at its full-scale reading, and it can accordingly be assumed that if a battery shows a good voltage when indicated by such an instrument, it will give at least the same voltage when delivering current to a radio-receiver.

Having passed the test successfully, the cells are assembled in the requisite number (according to size of battery) in cardboard boxes, the cells resting on a sheet of corrugated pasteboard at the bottom, and each separated from its neighbours by strips of pasteboard. The terminals and wire cross connectors are soldered on as indicated in fig. 2, which affords a comparison of size between the new (right) and the older smaller standard size to be seen on the left. All soldering operations are carried out with the aid of resin, no liquid fluxes being used, so as to avoid the formation of acids; electric soldering irons are employed.

At this stage the assembled batteries are subjected to further tests, fig. 3, the mechanical strength of the soldered wires being also checked; they are then allowed to stand in racks for several days in order that any incipient defects may have time to mature and reveal themselves in subsequent tests, which are applied before the batteries pass in rotation from the maturing racks to the waxing plant. Liquid paraffin wax is run into the boxes, as shown in fig. 4, the trays of batteries passing on to an endless belt conveyor, which carries them through a duct against a current of cool air, which sets the wax; all cardboard boxes and separators are impregnated with boiling wax to exclude moisture. Every cell is embedded solidly in the wax, and liberally spaced; the previously-mentioned sheet of corrugated paper at the bottom of the containing box assists the wax to penetrate beneath each cell bottom. After

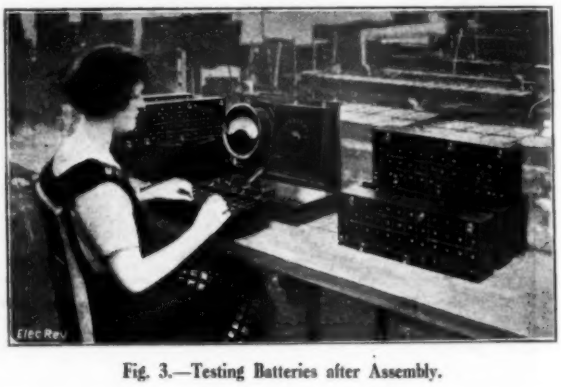


Fig. 3.—Testing Batteries after Assembly.

"topping up" to make good the shrinkage of wax, the surface is finished smooth by slightly heating it, and an electrically-heated and driven conveyor machine is being installed to carry out this operation automatically. Labels and printed instructions, at present stuck on to the side or top of the batteries, are to be "floated" under the surface of the wax. After a final test they enter the finished battery stores; on their emerging therefrom, a check test is applied, and each battery is stamped with a code mark to indicate its date of issue to a customer; packing in waterproof paper is facilitated by sealing-band machines.

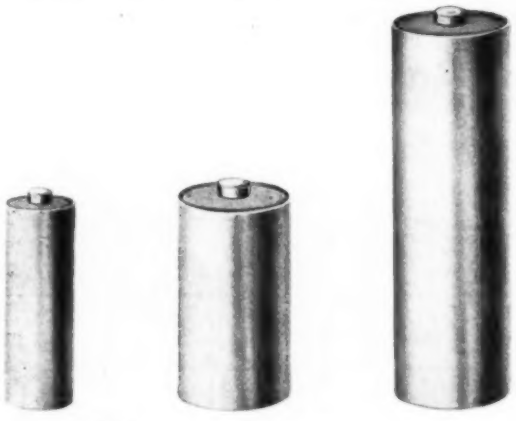
Fig. 4.—Filling Assembled Batteries with Liquid Wax.

It is now generally appreciated that a large plate-circuit battery not only assists reception, but is also more economical, notwithstanding its higher initial cost. The "RB3" type of battery consists of 48 cells giving 72 volts and weighing 15 lb., whilst the extra large-capacity pattern shown in fig. 6 is made up of 36 cells connected in series to give a nominal e.m.f. of 50 volts; its weight is 20 lb., maximum discharge rate 20 mA, and dimensions over the lid are $8\frac{3}{4}$ by $5\frac{3}{8}$ by $9\frac{1}{2}$ in. high. Both types are tapped and fitted with dull nickelled spring terminal clips. Thus, three types are now available, their respective maximum economical discharges being: small type, 5 mA; large type, 10 mA; and extra large, 20 mA.

The Company's products include grid-biasing dry batteries, which are now tapped in 1.5-volt steps, a needed convenience. Siemens inert batteries (originally known as the "Dura" type) are made in two 15-volt sizes, weighing 15 oz. and 3 lb. 4 oz. respectively. Their exciting agent is in the form of a powder that remains inert till the addition of clean water changes it into

a paste, thereby giving the cell the characteristics of a dry cell. The special advantage which is claimed for this form of cell is that it will keep, before being charged by the addition of water, for an unlimited time in any climate without deteriorating; it is, therefore, particularly suitable for use in hot climates and in other countries where it is essential to maintain large stocks.

To meet the requirements of those who prefer a wet primary battery for energising the valve-plate circuit, three sizes of Leclanché "sack" cells are made, their discharge rates being 5 mA, 10 mA, and 20 mA at 1.55 volts per cell. Each consists of a circular glass container, a semicircular zinc electrode (negative), and a sack element (positive) enclosing the carbon and depolarising material in fabric instead of a porous-pot,



Weight, oz.	1·25	3	6
Appx. capacity ratio ...	1	3	7·5
Price ratio	1	1·8	2·5

Fig. 5.—Standard Siemens Dry Cells.

which assembly reduces the internal resistance and increases the ampere-hour output. In place of sal-ammoniac crystals, "Siebrolyte" may be dissolved in water to form a viscous electrolyte, which renders the cell practically unspillable; when exhausted, the electrolyte is renewable.

Larger "sack" cells in earthenware jars with a maximum discharge rate of 0.5 A at 1.5 volts are suitable for heating valve filaments, and Siemens low-voltage dry batteries are obtainable for the same purpose; satisfactory service should result when the discharge rate is limited within the normal capability of the battery.

From what has been written, it will be appreciated that the range of dry batteries manufactured by Messrs. Siemens for radio purposes is a comprehensive one. In particular, to those radio enthusiasts who hesitate to use multi-valve receivers on account of the presumed necessity of employing accumulators for energising the valve-plate circuit, the Siemens "Super-Radio" dry battery should appeal strongly. In addition to those mentioned, other types are also made for general purposes, and the care taken in assembling them can only

Fig. 6.—Extra-large "Super-Radio" Battery.

be adequately appreciated by witnessing their manufacture. The testing facilities provided in the factory are very complete, for only by actual measurement after each operation which may tend to alter values can the reliability of the product be maintained.

In conclusion, our thanks are due to Messrs. Siemens Bros. for the loan of the photographs reproduced above no less than for the courtesy with which we were received on the occasion of our visit to their Woolwich works.

The Design of Extra-High-Pressure Cables.

The Permissible Current-Carrying Capacities of High-pressure Cables embodied in Curves for three-core and single-core Cables laid direct in the ground.

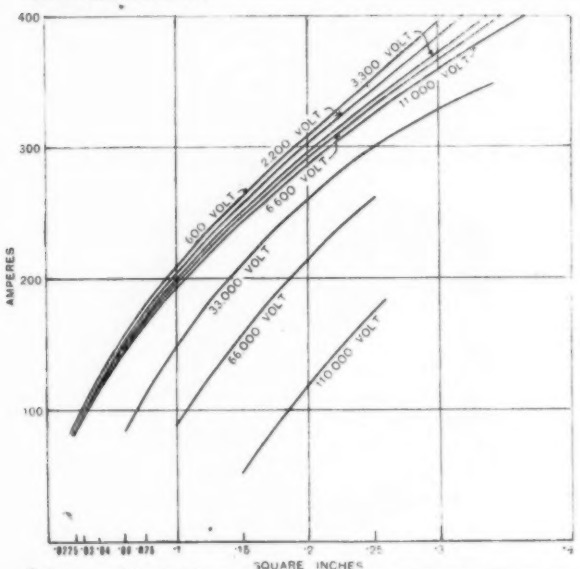
By E. BERRY NIXON, A.M.I.E.E.

THE numerous articles which have been published dealing with what would appear to be the whole of the crucial points connected with cables of low, medium, and high pressures tend to deter one from adding to their number. The only excuse offered for doing so is that this article deals with and gives views upon what has long been a matter of importance to all potential purchasers and manufacturers of super-pressure cables—authentic carrying capacities.

It is not suggested that we are at present "working in the dark," rather is it meant that individual knowledge should be pooled, and from the collective information tables which would be universally appreciated could be constructed; when considering the formation of these, that portion of the cable which is vital, the core, should receive the major thought. Whether this takes the form of one with a rope centre, hollow, or other design at present depends upon individual opinion; the writer's views on this point have often been expressed in this journal.

Either of the former designs is suitable, but preference can be given to that form used with the Brooks oil system and as employed on the 130-kV experimental line of three single-core cables, each 600 metres long, which has been in operation for a considerable time in conjunction with the overhead line of the Societa Interregional, Italy (ELECTRICAL REVIEW, February 26th, 1926, p. 349).

Quite apart from the value of the large amount of copper saved by using this type of core, the advantage of continual impregnation is apparent, and the continued use of solid stranded cores seems all the more strange if we consider impregnation and carrying capacity. The reduction of the ineffective copper, and the distribution of the electrosatic stresses on these large-diameter conductors, would appear to be strong points in favour of the hollow core.



Reduce capacities to 85 per cent. for two cables laid together; 80 per cent., three cables; 72 per cent., four cables.

Fig. 1.—3-core, p.i. Cable : Carrying Capacities.

The following curves indicating the current-carrying capacities of armoured cables laid direct in the ground are wide in their application as they include the lower voltages. Tables for these have already been published,* but the addition of them was made with the view of increasing the usefulness of the curves. The capacities of cables working at 33 and 66 kV are based on

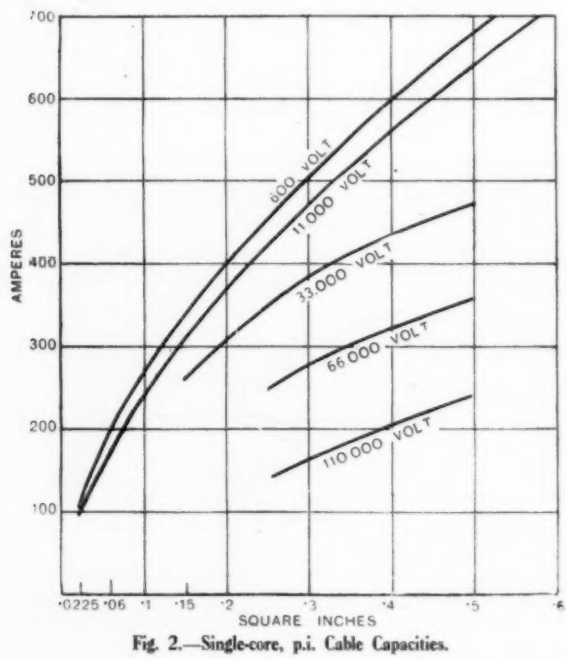


Fig. 2.—Single-core, p.i. Cable Capacities.

experience at these pressures, whereas those at 110 kV are purely theoretical, and in this case it will be realised that some modification of the normal style of a three-core cable would have to be made, possibly in the direction of the S.L. type of cable made by Messrs. W. T. Henley's Telegraph Works Co., Ltd.

* Permissible Current Loading of British Standard Impregnated Paper-Insulated Electric Cables (B.S.S. No. 1-1922) with Explanatory Notes.

Fig. 1 shows the current-carrying capacities for 3-phase, 3-core, cables at 50 periods for pressures up to 110,000 V. We have little or no experience of cable behaviour at this pressure to guide us, but it is fairly safe to decide what would appear to be safe and economical loadings. A cable for a capacity of 100 A at this voltage would, if based on the suggestions already given, consist of one or possibly two layers of core wires, the approximate core diameter being indicated by the sectional area; by this it is meant that the given section fixes the approximate diameter of core, while the amount of effective copper to be left inside this diameter is dependent upon the depth of current penetration.

The next set of curves, fig. 2, giving the current-carrying capacities for single-core cables, provides for three armoured cables being laid direct in the ground

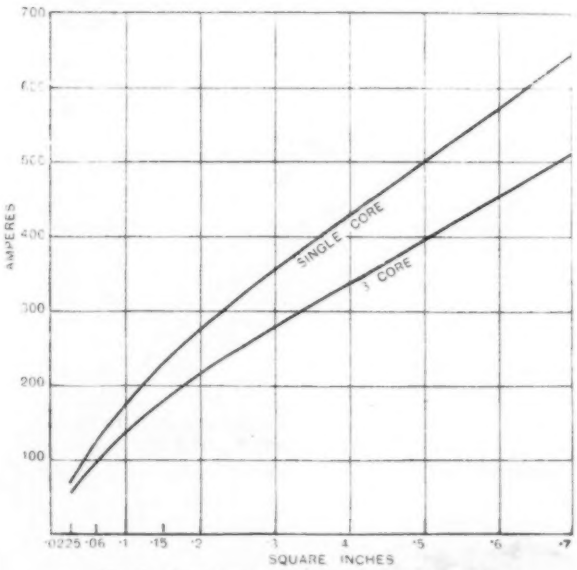


Fig. 3.—Capacities for Varnished-Cambric l.c. Cables.

for the pressures up to 11,000 V, but for the higher voltages they would be unarmoured. The current values suggested for the higher voltages are fairly accurate, and in the case of the 33-kV curve it would be possible to extend it to include cables of larger cross-sectional areas, but for general purposes it is not necessary to do so.

This opportunity is taken for including curves giving the suggested carrying capacities for varnished-cambric insulated and lead-covered cables for internal power station use, fig. 3, and in the case of the single core the basis is for three cables mounted together. It was intended to add curves to cover the higher pressures for this class of cable, but this has been left over until further figures are available.

Tests may prove that the values given in the various curves require some modification, but the curves should prove a useful guide until such time as it is possible to have them corrected. A table of core diameters, giving the actual amount of copper allowed, can be prepared for use with the permissible loading curves.

In conclusion, it is hoped the curves will prove to be of value to many readers and that some benefit will accrue from the above suggestions.

Smoke Abatement.

One of the new laws that became effective on January 1st, which specially affects the inhabitants of large cities, is the Smoke Abatement Act; it does not deal with the domestic chimney, but it increases the penalties for emitting smoke from industrial chimneys. Formerly it was an offence only when such chimneys sent out "black" smoke, but the new law includes white and grey smoke, grit, ash, and soot.

A Railway Electrification Scheme.

Completely Automatic Sub-stations, 33,000 or 12,000 V A.C., 1,500 V D.C. with Remote Control for Supplying the 30-mile line from Capetown to Simonstown of the Capetown Suburban Railway.

THE principal feature of interest in connection with a recent Press visit to the Witton works of the General Electric Co., Ltd., was a demonstration of the working of some of the apparatus which is to be used in connection with the electrification of the Capetown Suburban Railway. The scheme provides for the electrification of the track from Capetown to Simonstown, a distance of about 30 miles, and is believed to be unique in that it is the first occasion on which the equipment for supplying an entire railway line has been automatically operated and remotely controlled.

The power will be supplied from the Salt River power station, Capetown, and transmitted by both overhead and underground cables on a 33,000- and 12,000-V, 3-phase, 50-cycle system to six sub-stations along the track, all of which will be subjected to supervisory control from the generating station. Each "sub" will accommodate one or more pairs of 1,000-kW rotary convertors, each pair in series, for supplying the track at 1,500 V, and the necessary transformers and switchgear for obtaining automatic operation and supervisory control. Fig. 1 shows the outline of the scheme, which will be described in detail as follows:—

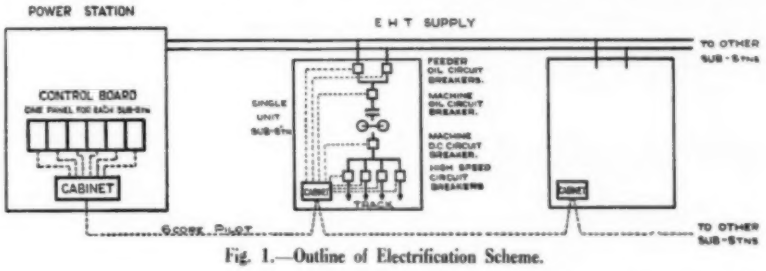


Fig. 1.—Outline of Electrification Scheme.

Fig. 2.—Machine Starting Panels.

An oil circuit breaker in each sub-station isolates each e.h.p. feeder cable from the station busbars, while a further oil circuit breaker is installed for disconnecting each pair of rotaries from the bars.

The machine starting equipment consists of two enamelled slate panels, fig. 2, on each of which are mounted three triple-pole contactors for starting, synchronising, and running purposes respectively, in addition to various auxiliary equipment for the machine operations. An interesting feature is a commutator-grinding switch, by means of which, when grinding is in progress, the starting contactors are closed, but the synchronising or running switches held open. The various relays and switching equipment essential to the supervisory and automatic operations at the sub-station end are accommodated on a slate-panel control board, fig. 4. This consists of a l.p. relay panel, a.c. and d.c. machine panels, and a number of outgoing feeder panels. The rotary operations are controlled by apparatus on the relay panel, which also houses an Angold leakage indicator.

On the convertor d.c. panel are the necessary instruments for indicating the load and field currents. Coloured lamps show whether the main d.c. circuit breaker is open or closed. The e.h.p. panel contains intermediate relays for closing the circuit breaker connected between the busbars and the transformer, and also a switch for the local operations. The usual indicating instruments are installed on this panel, and also a link box for testing and a three-phase time-limit overload relay for use with the oil circuit breaker. An auxiliary closing contactor is also provided for the remote control of the air circuit breaker. The feeder panels are similarly equipped.

The actual distribution is effected from a truck-type cubicle board accommodating the necessary incoming and outgoing feeders, designed and equipped in accordance with modern practice. In the incoming truck cubicle is mounted an air-break circuit breaker controlling the d.c. supply. An operating handle is mounted on the front of the truck for the local control of the breaker, referred to later. A butterfly nut handle must be operated before the truck is withdrawn, and should the circuit breaker be closed, the manipulation of this handle will open it automatically before the truck can be moved. The outgoing feeder trucks are similarly equipped, each being provided with a specially designed high-speed circuit breaker. The function of the butterfly nut of the incoming feeder truck is performed on the outgoing apparatus by an ironclad switch suitably mounted on the front of each cubicle.

A sub-station relay cabinet houses the entire equipment necessary to receive the controlling currents sent out from the power station, and, according to their number and sequence, selects the route to the intermediate relay or contactor which operates the desired apparatus. At the power station end the essential apparatus is a dispatcher's control board and a supervisory cabinet. The board has a panel for each sub-station, by means of which a load dispatcher controls the convertors and ascertains whether they are working satisfactorily. The mountings on each panel, fig. 5, are in such a position as to enable the operator to see from a single line diagram of connections the lay-out

of the plant he is controlling, and further, to ascertain immediately the location of any fault that may occur. The two incoming cables are represented at the top, and below these are two two-way control switches for the incoming circuit breakers, and two sets of two signal lamps, red and green, for indicating whether the corresponding oil circuit breaker is open or closed.

The e.h.p. busbars are next represented, and then the operating switch for the machine supply circuit breaker. Below this is shown the rotary-convertor set, and then the d.c. apparatus, with a similar arrangement of indicating lamps for the main d.c. breakers. There are also two white lamps on the panel, one at the top and one at the bottom, for indicating faults on the a.c. or d.c. systems respectively.

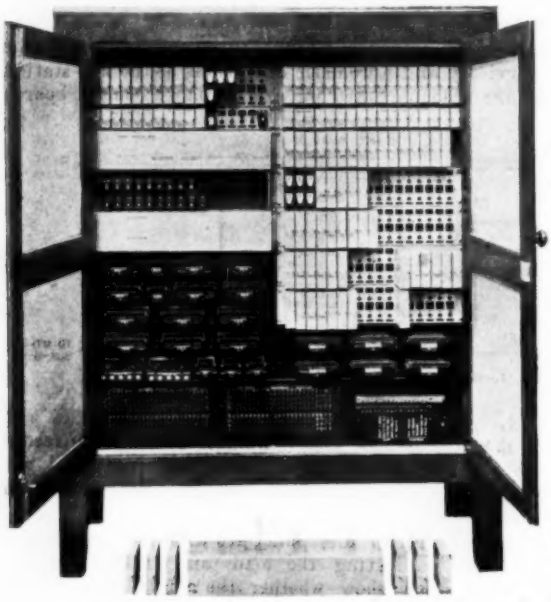


Fig. 3.—Generating-Station Supervisory Cabinet.

The selections of the supervisory remote-control system are arranged wholly by means of relays. A common control or pilot cable runs the whole length of the track, fig. 1, being looped into each sub-station, and is the medium for the supervision of the whole of the sub-station apparatus. Each circuit breaker functions by the simple operation of a single switch, and the selections are achieved by trains of self-generated impulses, the commencement of the impulsing being controlled at the transmitting end and its governing by the correct functioning of the receiving relay equipment. This is operated at 50 V from batteries installed at the power station and sub-stations.

The supervisory cabinet, fig. 3, houses the entire relay equipment for generating and transmitting, in their proper sequence, the impulses, and also the relays required to receive those sent back from the operated circuit breakers, which set up the circuit conditions required to light the signal lamps concerned. The selections of the apparatus and its operation are governed by a series of three trains of impulses. One selects the sub-station, another the group of circuit breakers and the operation to be performed, and a third the required breaker. The first impulse train is received by all the sub-stations, locking out the unwanted ones, and the two subsequent trains of impulses are only received by the selected station. When a circuit breaker has been selected, an indicating signal is sent back to the control station. If this agrees with that sent out from the control station, the operation is allowed to proceed.

The rotary convertors are started by specially designed pony motors and are self synchronising, the synchronising current being limited by means of choking coils inserted between the l.p. side of the power transformers and the machine slip-rings.

After the e.h.p. busbars in the sub-station have been energised, the machine circuit breaker is closed and the rotary-convertor set starts up, synchronises, and parallels with the d.c. bus-bars. The outgoing feeder high-speed circuit breakers are then closed by supervisory control. Where the sub-station has more than one rotary-convertor set, the machines are automatically paralleled when both are required on supply. The attendant at the power station operates the control switch of the rotary-convertor set he wishes to start, and the appropriate intermediate relay is selected and energised by the supervisory gear. The operation of the intermediate relay closes the convertor breaker, and the completion of this operation is indicated by a lamp in the power station, operated by auxiliary contacts on the breaker. The breaker operating transformers are now energised, and an interlock on the breaker completes the circuit which closes the starting contactors, the polarising fields being also switched on to both machines from the sub-station battery. The closing of the starting contactors completes the starting-motor circuit, and the machines run up to speed and build up their field circuits in a similar manner to d.c. generators. When the fields have reached a predetermined value and the machines about 90 per cent. of the synchronous speed, the voltage relay closes, and this in turn closes the synchronising contactors. The full transformer voltage is now connected to the armatures of the rotary-convertor sets and the synchronising chokers in series.

The synchronising relays which are connected across the contacts of one pole of each running contactor become de-energised when the machines are in step and, after a time delay, make contact. As each synchronising relay makes contact, circuits are completed which close the running contactors. When the rotary-convertor set synchronises, an interlock on each running contactor brings the field regulator into operation, and the voltage of the machine settles down to the value determined by the regulator.

When both machines have synchronised and their field relays functioned, the operating circuit for the d.c. breaker is completed and the rotary-convertor set parallels on the d.c. bus-bars. Interlocks on the d.c. circuit breaker then energise the supervisory gear, and the lamp in the power station indicates that the machine is on circuit. When shutting down a rotary-convertor set, after the control switch is set to the " off " position, the supervisory equipment selects and operates the required intermediate relay, which, in turn, completes the circuits for tripping the machine breakers simultaneously, and the remainder of the gear resets ready for the next occasion of starting up.

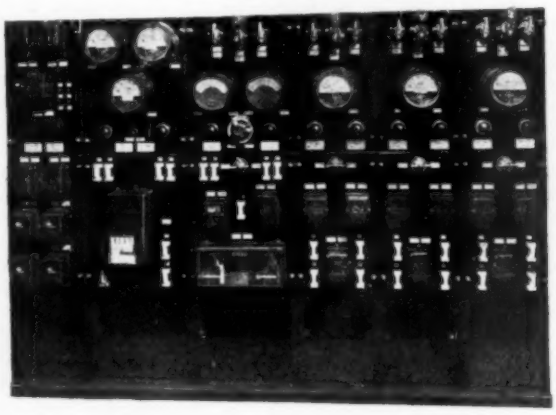


Fig. 4.—Sub-station Control Board.

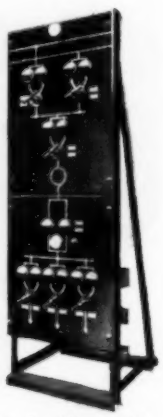


Fig. 5.—Dispatcher's Control Panel.

For testing or other purposes, arrangements are made for the local control of the sub-stations. In such a case

a "local and distant" controller in the sub-station is switched on to the "local" position, transferring the control to the sub-station control switches.

The machines are fully protected to meet any emergency. A voltage and phase relay prevents the rotary-convertor set from starting up, or shuts it down, when the e.h.p. voltage is low, or a phase is broken or reversed. Inverse time-limit overload and instantaneous earth-leakage relays are installed on the e.h.p. side of the rotaries. Each machine d.c. breaker is fitted with an overload relay having a time lag and a reverse-current relay. To guard against reversed polarity when starting up, polarised fields are fitted to the convertors. These have a 2- or 3-minute rating and are switched on during starting and excited from the battery. Further, should the machine build up with wrong polarity, reverse-polarity relays will shut down and lock out the set. If the set fails to synchronise within a given time, a stalling relay shuts it down and locks it out.

A system of earth-leakage protection, patented by the G.E.C., is used to protect the l.p. windings of the transformers, machine armatures, and the field systems, and will, it is claimed, shut down and lock out the rotaries on the occurrence of a 3 per cent. fault to earth. The machines are further protected against overspeed, unbalanced phase current, overheating, and field failure.

Particular attention has been given to the design of the relays; no oil dash-pots are employed and all the time-relay devices depend on revolving aluminium disks with magnetic braking. The polarity and reverse-current relays are designed to operate across ordinary ammeter shunts, absorbing only 0.075 V at full load.

Fig. 6 shows one of the rotary-convertors included in the contract, and it is interesting to note that the shielding shown is of 5-ply wood. The whole of the apparatus, with the exception of the e.h.p. machine

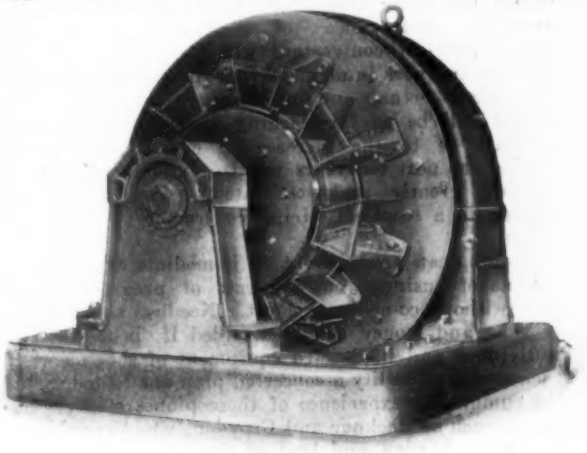


Fig. 6.—Shielded Rotary Convertor, 1,000 kW.

breakers, is being supplied and manufactured by the G.E.C., the supervisory control equipment being made at the Peel-Conner Telephone Works.

The Electric Market-Place of the Future.

A Scheme for Establishing Centrally Situated Electric Market Places Throughout the United Kingdom.

By HERBERT H. BERRY.

THE year 1927 is full of promise for the Electrical Industry and, in my opinion, will mark a new era in the development of Domestic Electrical Engineering.

Whatever may be said of the merits or de-merits of the Electricity Bill which has become the law of the land, there can be no gainsaying that it will give a steadily increasing impetus to the sale of domestic electrical appliances. Many of the existing domestic anomalies will be removed, and it is to be hoped that it will not be long before the complaint is disposed of that whereas energy for heating and cooking purposes on one side of a road is ¾d. per unit, on the other (virtually) it is 3d. a unit, or 300 per cent. higher, while in outlying districts the discrepancy is even greater.

There is, however, in my opinion likely to be a vastly greater advance, even than the levelling-up of current rates, due to the historical fact that the feud between the Incorporated Municipal Electrical Association and the Electrical Contractors' Association Inc., which has existed for 17 years, is now definitely, and, I believe, permanently ended. Moreover, the incidence of the passage of the Electricity Bill through its successive stages in the Houses of Commons and Lords, during the period of *rapprochement*, has made it possible to get into the Bill a special Trading clause, with certain safeguards, which has not only been agreed by the respective parties to the old dispute, but which also includes among its signatories all the existing Electrical Associations which enjoy beneficial interest.

The situation, as I view it, therefore, will be briefly that the Electricity Act will gradually free a large number of engineers whose attention will be largely diverted to the development of their domestic load, and the consequent improvement in load factor.

It has been stated repeatedly that their avowed object in seeking "selling powers" is for the purpose of increasing the sale of current, and not for the purpose of making profits out of wiring and fittings to the local contractor's detriment. The safeguards introduced into the Bill have that premise in mind, and Advisory Committees will endeavour to stabilise the goodwill which has now been established between the parties.

From January, 1927, onwards, the lately contending parties will be working together for the benefit of the public in general and themselves in particular. I look forward to the time in the immediate future when the following dream will be realised.

My vision is that there shall be created in every city, town and village in the country an Electric House or Electric Market Place centrally situated and built on a "common plan." The standard plans, varying in size according to the population of the town or village, will be approved by a special Committee representing

the interested parties. The Electric Home atmosphere once created, with an adequately equipped Lecture and Demonstration room, what could be more fitting than that the Electrical Development Association should arrange a "Circuit" for lecturers and demonstrators, drawn doubtless, to a large extent from the Manufacturers' and other Associations vitally interested in the economic furtherance of electrical propaganda? Local electrical contractors will co-operate with the resident engineer in an endeavour to crowd the building with their actual and prospective customers. The results will be so far-reaching that the Government estimate as to the increase in current per capita during the next ten years will be found in my humble opinion greatly under-estimated. Herein lies the answer to a sceptical wiring contractor (if such still exists).

Nothing can now prevent an immediate expansion in volume of business, but the rate of progress will be slow without co-ordinate effort. Needless squandering of time and money can be avoided if, instead of an individual and haphazard equipment of showrooms in each separate locality a concerted plan is adopted, using the cumulative experience of those pioneers in electric houses such as Hackney and Croydon, who have already borne the burden and heat of the day, added to the selected skill and knowledge of manufacturers who "deliver the goods," plus the service that can be rendered by the British Electrical Development Association. It is quite conceivable that an architect will readily evolve a series of suitable schemes that will place the Electric House or Electric Market Place of the near future on a pinnacle so conspicuous that Great Britain will soon stand in the forefront as regards commercial domestic electric penetration.

In the meantime and during the period of transition an important development has taken place in another direction. A strong Electrical Exhibition Committee has been established comprising elected delegates from each of the industrial associations and the electrical undertakers.

The business of this Committee (which operates under the sheltering wing of the British Electrical Development Association) is to deal with all matters appertaining to the twelve classes of electrical exhibitions ranging from the world type such as Wembley to the minor local and travelling shows.

Those who are contemplating the holding of electrical exhibitions, of whatever magnitude or class will do well to send their preliminary inquiries or proposals to Mr. J. W. Beauchamp, Director of the British Electrical Development Association, 15 Savoy Street, Strand, W.C.

The Electrical Exhibition Committee of which the writer of this article is Chairman, will welcome constructive suggestions in any shape or form. Every attempt will be made to avoid overlapping of the dates of small shows and attention will be given to the "passing on" from one locality to another in the vicinity.

The existing wasteful methods of exhibition propaganda will be as far as possible curtailed by a process of co-ordination, and it is reasonably felt that with the same capital expenditure as formerly a vastly greater beneficial result will be obtained. Let us, therefore, take heart for the future, and for 1927 in particular.

For the first time in English history we have all the great industrial associations agreed upon a common plan. The loyal co-operation of the individual members to support the policy of their responsible leaders is all that is now needed, and it should be the duty of every member to strive earnestly to that end.

Let it be freely known that a new spirit of camaraderie now exists and that the old political differences are for ever buried with the Old Year.

Arc Welding Aided by Hydrogen.

Important Practical Processes result from Scientific Investigation; the Heat of Association of Atomised Hydrogen is used to intensify the Flame, and a Gas Envelope to prevent Oxidisation.

By P. L. ROBERTS.

TWO new adaptations of the electric arc, as employed for welding metals, have been developed as a result of investigations in pure science in the research laboratories of the General Electric Co. of America,* and recently patented. Both attain the same end by the use of different means, and are equally important in that they produce welds of extremely good mechanical properties; a further common advantage is the high speed of welding which can be attained. The first of these processes is known as "atomic-hydrogen arc welding," and owes its origin to the research work of Mr. R. A. Weiman and Dr. Irving Langmuir. The second process also involves the use of the well-known metallic arc, but in an atmosphere of hydrogen, and was investigated by Mr. P. Alexander partly under the direction of Dr. Elihu Thomson.

Atomic-Hydrogen Arc Welding.

The source of welding heat is not directly the electric arc, but the heat of association of hydrogen atoms. It is well known that hydrogen under atmospheric conditions exists in molecular form; if the temperature of the gas is raised sufficiently, it splits up into atoms (two hydrogen atoms to the molecule) and absorbs an enormous amount of heat during the change; as the temperature falls and the atoms recombine to form molecules, the same large amount of heat is given out. Use is made of this heat of association in the atomic-hydrogen process of welding.

The apparatus consists of two electrodes, preferably made of tungsten, held in two insulated heat-resisting holders, which are included at an angle of 45 deg. to each other, and held in close contact with each other under the action of a spring. The electrodes are separated, for striking the arc, by means of a small finger lever. The current is supplied to the electrode by means of a flexible cable fastened to the end of each. The electrode holders and cables are mounted on an insulated handle. Running through the handle with the cables is the hydrogen supply pipe, at the end of which a small jet is arranged immediately above the point of contact of the electrodes in such a manner as to impinge a jet of hydrogen through the arc. The other end of this pipe is connected to a rubber tube which supplies the gas from a near-by cylinder.

The voltage necessary to strike and maintain an arc in hydrogen is much higher than that needed for one

*See ELEC. REV., April 16th, 1926, p. 627.

in air; the characteristics of the electricity supply are, however, similar to those required for metallic-arc welding. If, then, direct current were used from the mains, a series resistance would be necessary for stability, and a line voltage of 250 V; if a reverse compound-wound generator were used, a lower voltage of approximately 175 V would be sufficient for arc striking. When alternating current is used, reactance in series with the arc and a supply voltage of from 350 to 400 V ensures satisfactory arc striking. The voltage drop across the arc is 80 V, as against 25 V for the metallic arc alone, and from 40 to 60 V for the carbon arc. The requisite current varies from 20 to 70 amps. according to the thickness of the work being welded.

The gas used varies also in proportion to the thickness of the work from 20 to 30 cu. ft. per hour. Tungsten electrodes are used on account of their resistance to disintegration under the intense heat of the arc. Their consumption varies from 3/16 in. to $\frac{3}{8}$ in. for every foot of plate ($\frac{3}{8}$ in. to $\frac{1}{2}$ in. thick) welded.

The *modus operandi* is simple and similar to that of an oxy-acetylene blowpipe. The hydrogen is turned on and the electricity supply switch closed; then the electrodes are separated by means of the lever referred to, so striking the arc. The flame formed by the arc and ignited hydrogen is directed on to the work to be welded, the arc being held about $\frac{1}{2}$ in. from the surface. The stream of hydrogen passing through the arc is heated to such a high temperature that it dissociates into atomic form, absorbing heat from the arc in doing so. Immediately the stream of atomic hydrogen strikes the surface of the metal to be welded, it reassociates to form molecules and the heat absorbed from the arc during the first change is given up to the metallic surface, raising it at once to the melting point.

The apparatus is light and flexible and may be held in the hand, or moved along the joint with the same action as an oxy-acetylene blowpipe. The process has all the advantages of the intense and local heat of the metallic arc, combined with the advantages of the oxy-acetylene source of heat, which is independent of any added metal. Additional metal may be added, as and when required, in the form of a rod of the same composition as the parts being welded. Another point in favour of the process is that metals can be penetrated with the flame to a depth of from $\frac{3}{8}$ in. to $\frac{1}{2}$ in. This obviates the necessity, usual with other processes, of preparing the work by bevelling or veeing for the reception of added weld metal and ensuring proper fusion. For instance, two plates 1 in. thick could be fused together completely by simply butting their edges and welding them on one side and then the other. Thus, considerable economy is effected in preparation alone, apart from the increased speed of welding which such penetration means. No rates of welding for the process are yet available.

The Hydrogen Metallic-Arc Process.

In this process the ordinary metallic arc is used, but surrounded by an envelope of hydrogen to prevent the oxidisation of the weld. The apparatus for accomplishing this consists of a blowpipe, much like the pattern used for oxy-acetylene welding; the metallic electrode is fed through the head of the blowpipe, which is fitted with a gas-tight gland, and out of the other end to the work. Surrounding the electrode guides inside the head is an annular space into which the gas is supplied by means of a side pipe, connected to a length of rubber tube. The open end of the blowpipe is just a small annular orifice for the exit of the gas, through the centre of which the electrode passes, so that it is at all times surrounded by a protecting envelope of gas. The hydrogen side pipe and the pipe through which the electrode passes to the head are shaped to run closely parallel to each other and at right angles to the blowpipe head; an insulated tube over both forms a suitable handle for wielding the blowpipe. The electrode wire passes through a flexible casing like a Bowdon cable, of sufficient length to give wide and free movement; the wire is fed automatically by an electric motor from a large reel. This is obviously the only satisfactory way of supplying electrode material, as the usual short hand-fed electrodes would have to be continually fitted through the gas-tight gland, with the loss of much time. The rate of feed of the electrode is automatically controlled by shunting the feed motor (of the reversing type) across the arc circuit, by which means fluctuations in the arc circuit are made to cause counter fluctuations in the motor circuit.

A modification of the apparatus consists of surrounding the work with a box into which the hydrogen is fed: an ordinary short electrode may then be deposited on to the work through a slot in the top of the box. As an alternative, the gas box may be made small and attached to the electrode holder, so that it moves over the work with the electrode.

The electricity supply required is similar to that for the atomic process. A striking voltage of from 180 to 200 V is necessary, while the voltage drop across the arc varies from 60 to 100 V for arc lengths of from 3/16 in. to $\frac{3}{4}$ in. When alternating current is used, an arc striking voltage of 300 V is necessary. The current required is approximately that needed for ordinary metal-arc welding, *viz.*, from 50 to 250 amps., according to the thickness of the work. The amount of gas employed is approximately 30 cu. ft. per hour at a pressure varying from 5 to 10 lb. per sq. in.

The process, like the atomic flame, has the property of deep penetration into the work being welded. This obviates to a large extent the usual necessity of preparing the work, directly increasing the speed of welding. The average rate of welding $\frac{1}{4}$-in. plates with the metallic arc is 15 ft. per hour (welding from alternate sides), while with the hydrogen metallic-arc 60 ft. has been welded in the same time. The method of operation is similar to that of manipulating the ordinary metallic arc, except that the arc length may be varied within wider limits without detriment to the weld. The gas is turned on and ignited before commencing to weld.

Experiments have been made to determine the suitability of other gases as a protective envelope. Coal gas, nitrogen, and carbon dioxide were tried, but not with such good results as could be obtained in air. It was found that the efficiency of the gas varied directly with the amount of hydrogen it contained. Water gas, containing 50 per cent. of hydrogen (by volume) was found to give good results, with the advantage of being cheap. For the sake of portability, liquids which can be made to produce a large proportion of hydrogen were tried. Methanol, which vaporises at 700 deg. C. to form hydrogen and carbon monoxide, was used with success; one gallon will produce 230 cu. ft. of gas, enough for nearly 8 hours' continuous welding. Ammonia, which consists of 75 per cent. hydrogen and 25 per cent. nitrogen by volume, vaporises into these gases at 600 deg. C.; 50 lb. of ammonia will produce 2,250 cu. ft. of the mixed gases, and the addition of the gas in liquid form to the usual apparatus for arc welding will have little or no effect on its portability.

Particular Features of the Processes.

The properties of the welds produced by both processes are similar, and will therefore be considered together. Owing to the intense heat of the arc, some of the hydrogen used in the second process is atomised, as when done intentionally in the atomic flame. Hydrogen in the atomic state has a very great affinity for oxygen, the result being that no oxygen, or other gas, from the atmosphere can reach the weld so long as there is a stream of hydrogen directed on it. The outer layers of the enveloping gas combine with the oxygen to form water, which passes off as steam. Even metallic oxides, such as rust, previously formed on the material being welded, are reduced to metal. In this way, the hydrogen is not only a preventative of oxidisation, but is an active flux for the metals under treatment. The result is to produce welds of high mechanical properties, the most important of which is remarkable ductility. A characteristic example of the properties of a mild-steel

weld made by the hydrogen metallic-arc is given below with average figures for welds made by the ordinary metallic-arc process:—

Method.	U.T.S. tons/sq. in.	Elastic limit.	Reduction of area per cent.	Elongation per cent.
Metallic arc ...	22.0	—	—	4.0
Hydrogen metallic-arc	25.0	42,000	55.0	36

A metallic-arc weld will usually only bend through an angle of from 20 to 30 deg. before fracture, but repeated tests on hydrogen-welded samples allowed of a bend of 180 deg. being made without fracture. Welded strip-steel has been rolled and drawn without fracture, a further demonstration of ductility. The atomic process is not limited to mild steel; high-speed steels containing vanadium, molybdenum, and cobalt have been welded with success. "Stainless" steels containing as much as 15 per cent. chromium have also been welded satisfactorily, and cast-iron may now be welded by either process with the advantage that such important elements as carbon and silicon are not burnt out. Equally good results have been obtained by the atomic process for welding copper and some of the copper alloys, and even aluminium.

Both processes may be adopted for automatic welding. As already indicated, it is desirable that the electrode in the hydrogen metallic-arc apparatus should be automatically fed at the same rate that it is deposited. Such an arrangement has not been tried with the atomic process, and would in any case be difficult in view of the nature of the apparatus. Either appliance, however, may be mounted on traversing gear over the work, and moved at a uniform rate along the joint, but this arrangement is only economical and even practicable on such work as straight or circular tank seams.

The high rate of welding which may be attained by the use of these processes opens up a very wide field of possible applications, purely on economical grounds. The other great advantage of ductility, equal to that of rolled or drawn metal, at once widens the scope beyond the present applications of the ordinary methods. Such structures as steel building frames, ship's hulls, and boilers suggest themselves as applications. The possibilities are very considerable, and point to a deservedly great future.

Correspondence.

The "H" Type of Cable.

Like Mr. Nisbett, I was amused by the article on Hochstadter's Cable in your issue of December 17th, but apparently for reasons dissimilar to his. I was amused, too, by his letter in the current issue of the REVIEW.

To say that I cannot understand his letter would be to underrate my intelligence, and so I do not say so. But I do say this: That the reasons given for condemning "H" type cable are inadequate. In fact, the whole letter strikes me as an attempt to silence opposition by making a loud noise. So, briefly, I will examine each of his paragraphs.

It may be granted that the screening does not prevent ionisation within the cores; but, by reducing the potential gradients, it reduces the tendency to ionisation. It may also be granted that the difficulty of impregnation is increased, but the increase is so slight that proper manufacture can easily overcome it.

That the withstanding of tangential stresses is within the capabilities of a well-made cable does not prove that a cable without such stresses is not a very desirable thing. In fact, Mr. Nisbett's statement on this point verges on one of those negative arguments far too often used by engineers.

That the Hochstadter cable is more costly to make than the belted type is not proved, for, by the elimination of tangential stresses, less insulation for the same reliability is required in the one case than in the other. In any case, cannot the one be bought at the same price as the other?

I am unable to agree that the screened cable is mechanically weaker than the belted type, because in any 3-core cable subjected to bending, the cores move relatively to each other and to the sheath; and such handling as I have given to Hochstadter cable has deformed the cable no more than similar handling of a belted cable. Further, transforming of the cable from a circular to a triangular section does not necessarily increase the cubic contents. Rather, the reverse is the tendency.

Why is the table of curves so unfair to the belted cable? Whether or not the P.F. tests indicate the quality of the cable matters not at the moment, but as a practical comparison was aimed at, it is to be presumed, although it is not explicitly stated in the article, that the experimental lengths were manufactured of similar paper similarly impregnated, and so the results obtained do throw light on the comparative values of the two methods of construction.

Those results show that there does seem to be reason for the claim that "H" type cable will carry more current than the belted type by reason of its lower dielectric losses. The additional heat conduction due to the thin film of metal round the cores may be quite small, but the increased heat conduction due to the thinner paper walls is considerable.

It would be interesting to read Mr. Nisbett's other points, but if they are not better grounded than those he has brought forward, I, for one, fear that, as in the present case, I shall disagree with him.

C. E. Watson, M.I.E.E.

Matlock Bath, *January 2nd*, 1927.

In your issue of December 31st, Mr. Nisbett pours scorn on the equipotential sheath construction as an old idea which has been tried and found wanting.

It frequently happens in the course of scientific progress that a principle is known for some years before any satisfactory means of applying it practically is developed. A classical instance will serve to illustrate this. Heaviside wrote in 1887: "It is the very essence of good long-distance telephony that inductance should not be negligible." It was not until some thirteen years later that it was first successfully applied to any actual line, and now that the necessary conditions are more fully understood, it is in universal use.

The principle of the equipotential sheath is admittedly not new; the patent dates from 1914. That Mr. Nisbett tried it some years ago and found it of no value does not mean that the principle is wrong, but only that he has apparently failed to find the correct conditions for its use.

What are his objections to it?

1. He says the screened cable is more difficult to dry and impregnate satisfactorily. Perhaps it is, a little, but the difficulty is easily overcome by suitable manufacturing methods, and once they are overcome it is actually easier to maintain uniform quality in output.

2. He says the tangential stresses are within the capabilities of the dielectric strength of a well-made cable. They are, on first manufacture if the impregnation is good, but do not remain so in service. Most breakdowns have been initiated at the point where tangential stress is greatest.

3. He says the three-core cable is unmechanical, and a cable made without a belt will be visibly triangular after handling. That depends on manufacture. Properly made with adequate filling, an "H"-type cable is no more liable to become triangular than any belted type.

4. He says that a power-factor voltage characteristic can be obtained with the belted type, which is as good as that obtained with the "H" type. This is nearly true on first manufacture. It is very far from accurate if the comparative tests are made on cooling after a full-load run sufficient to raise the core temperature to its working maximum. The belted-type cable shows a sharp rise in power factor on cooling after a heat run, *i.e.*, under service conditions. The "H" type shows practically no change. Stable characteristics are vital to permanent service.

5. He deduces that there is no foundation for the claim that the "H"-type cable will carry more current than the belted-type cable by reason of its lower dielectric losses. He is right. It will carry more current, however, although not for that reason. The main reason lies in the smaller dimensions to which it can be made to operate satisfactorily and to a slight extent only to the heat conduction along the sheath.

The equipotential sheath is sound in principle, but it is not the sole requirement of a good cable, and harm is sometimes done by over-enthusiastic advocates who claim too much for it. Although known for many years, its development was retarded by the difficulty of finding a suitable material for the equipotential sheath. That is now obtainable, and coupled with improved materials, satisfactory mechanical construction and methods of impregnation, it offers a satisfactory solution of the high-voltage cable problem.

Standard Telephones & Cables, Ltd.
G. H. NASH, *Chief Engineer.*

London, *January 3rd*, 1927.

I have read with interest the criticisms contained in Mr. G. H. Nisbett's letter (ELECTRICAL REVIEW, December 31st, 1926) relative to an article which appeared in your issue of December 17th, headed "A High-pressure Cable Development."

From Mr. Nisbett's letter of December 31st, and also from his letter to the *Electrical Times* concerning the same subject on December 23rd, one would be almost justified in thinking that the author of these letters was fully convinced in his own mind that the usual type of super-tension cable, which has been employed in the past, is the "ne plus ultra" of cable design, at least for pressures up to 33 kV.

For my own part, I am quite prepared to leave this question to be decided by those engineers who have had extensive experience with 33,000-volt normal-type cables.

The Hochstadter patent was taken out in 1914, but the special metallised paper was not then known. The war naturally delayed further development of the "H"-type cable.

but immediately afterwards American and Continental makers were not slow in taking up the " H "-type cable again, with the result that " H "-type cables for super-tension work have been successfully used for years past, after most exhaustive tests and experiments.

The fact that all the leading cable firms on the Continent, as well as six British firms, are now making the " H "-type cables, tends to prove that the principles on which the " H "-type cable is based are not only electrically, but also commercially, sound.

With reference to all the points raised by Mr. Nisbett, these have been disproved in actual practice, and not merely by factory tests; and as to the " H "-type cable being an unmechanical proposition, this is not correct, as the " H "-type cable may be handled and laid with, comparatively speaking, more ease and safety than the belted type of cable.

Concerning Mr. Nisbett's criticism of the power factor and voltage curves, I would like to remind him that in his letter to the *Electrical Times* he stated that " experience shows that power factor relative to voltage is an unreliable index to the dependability of a cable." Why, then, does Mr. Nisbett go to such length in criticising the various curves as published in the ELECTRICAL REVIEW of December 17th if this point is not of importance?

As a matter of fact, Mr. Nisbett's own explanations and criticisms *re* power factors are not at all clear, and I would say that the differences appertaining to the power factors of the Macintosh cable and the Birmingham Corporation cable are wholly dependent upon the temperatures at which the respective tests were made.

F. Richardson,

Research Department, Enfield Cable Works, Ltd.

Brimsdown, *January 3rd*, 1927.

Power Supply for Wireless Sets.

I note in your issue of December 24th a further letter from Mr. H. Hewlett on this subject.

If one does assume that the h.t. battery is going to receive no proper attention, it appears to me that neither accumulators nor any other type of wet cell would be really satisfactory, and one is reduced to the old-fashioned dry battery. But what I wished to point out in my last letter was that more enlightened views are now largely held, and certainly none of our clients are ever left to get their batteries charged " as best they can," except at their own special request.

With proper arrangements, the only attention needed is (*a*) to put the battery on charge by operating a switch about once a week, and to leave it on until the set is wanted next day, and (*b*) to look at the battery once in four or five months and top it up if necessary.

A more serious matter, however, is the estimate given by Mr. Hewlett as regards current consumption. Modern sets, in which precautions are taken to get something approaching distortionless amplification, invariably demand high currents for the last valve. Our own smallest set, using one ordinary and one power valve, consumes 13 mA, which rises to about 20 mA for the largest set, and I would emphasise that in the present state of our knowledge *it is impossible to get distortionless loud-speaker work with less current*, except by the use of excessively high voltages: in other words, a power of about 3 or 4 watts d.c. supply to the anodes is essential.

For those who are unfortunately compelled to use primary batteries, we invariably specify a capacity of the order of 9,000 milliamp.-hours as the minimum which is likely to be satisfactory: such batteries (which we do not trade in ourselves) cost approximately 25s. per 50-volt unit.

P. K. Turner.

Research Department, Burndept Wireless, Ltd.

Blackheath, *December 29th*, 1926.

Boiler-house Efficiency.

I should be much interested if your readers could tell me of a simple way of obtaining boiler-house efficiency—that is, without going too deeply into chemical and combustion problems. Some time ago articles on this subject appeared in the REVIEW, but although they were excellent, they were not so clear to me as they have have been to more studious readers.

December 24th, 1926. **A. W.**

[Possibly the methods devised by Mr. R. H. Parsons would meet the case. The system was described in the ELECTRICAL REVIEW of February 21st, 1919, and the article, reprinted in pamphlet form (" The Coal Consumption of Power Plants, and Bonuses for Coal Saving ") is obtainable from this office.—EDS. ELEC. REV.]

Small British Motors.

We have been trying to obtain a British-made electric motor of one-third h.p., of the repulsion induction type, for single-phase circuit. We have sent out several inquiries, but in the majority of instances the quotations seem to be for motors of American origin.

Can you please give us the names of English firms who are likely to make such a small motor of the type mentioned? We must have one of the repulsion induction type, as the starting torque is approximately 180 per cent. full load.

December 29th, 1926. **Coldair.**

An All-Electric House.

A Harrogate Enterprise.

A RECENT development in the demonstration of domestic electricity is the all-electric house which has been equipped and recently opened for a short period to the public at Harrogate by the Corporation Electricity Department and the local contractors, with the object of demonstrating the latest electrical equipment for lighting, heating, and cooking, and the help, by increased convenience and comfort, which can be rendered to the amenities of domestic life only by electricity. Harrogate is a particularly suitable place for such an enterprise by virtue of its reasonable scale of charges for electrical energy. Lighting and heating can be obtained at 4d. and 1d. per kWh respectively, with the option of a ratable-value tariff.

We have received from Mr. Geo. Wilkinson, M.I.E.E., the chief engineer and manager of the Electricity Department, the following particulars of the apparatus installed. The house is an ordinary middle-class, two-storey dwelling of eight rooms, including a lounge, dining-room, kitchen, and five bedrooms, in addition to the hall and bathroom. Each room is equipped with the appropriate electrical apparatus, which includes fires and lighting fittings in each room, a cooking stove and washer in the kitchen, and an automatically-controlled cylinder water heater in the bathroom. A special feature of the installation is an electric thermal storage plant for heating the dining-room and supplying hot water. The illustration shows the dining-room, in which this is installed; it is in the form of the sideboard, on the right of the illustration, which harmonises with the

Dining Room, Harrogate.

other furniture in the room. The panels are of brown cork, and on the left-hand one is a thermometer showing the temperature of the water. The apparatus holds 50 gallons of water in a rectangular steel tank; the surface of the water is covered with oil to prevent evaporation, and also oxidisation of the tank. Submerged in the tank is a 12-gal. copper cylinder which is fed from a ball-tap cistern overhead, and supplies the kitchen and bathroom. Its contents are heated from the external water which is provided with a 2-kW immersion heater. The water temperature is controlled by a metallic thermostat located in the base. A fan propels air through the heater for warming the room, and is supplied from the lighting circuit, its consumption being about 40 W. A second thermostat controls the room temperature and puts the fan in and out of operation. It is claimed that this thermostat maintains the temperature of the room within a 1 deg. F. variation. Under normal conditions the storage heater is on an alternative circuit to that of the ground-floor heating and cooking; when the circuit is broken at night, indicated by a pilot light, the operation automatically closes on the thermal-storage circuit. Conversely, when the heating and cooking circuit is put on in the morning, the thermal-storage circuit is automatically broken, thus ensuring that no current is taken by the storage apparatus except during bed-time hours. In cases where an abnormal amount of water may be required, provision is made for the apparatus to be supplied from the heating circuit during the day. Electricity for the normal night consumption is supplied at a special low rate, thus rendering the apparatus quite competitive with coal or gas heating.

Electrical Currency.

The *Daily Mirror* reports the following conversation which took place at a garage:—

Customer: " What is the charge for this battery? "
Manager: " One and a half amps."
Customer: " How much is that in English money? "

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official campaign report for the fortnight ended January 1st states that two more demonstration homes have been opened—one at Wembley and Potter's Bar and the other at Walsall. The fifth Birmingham demonstration house is to be opened next week. A house was to be opened at Bishop Auckland on Wednesday last; this will be a specially-constructed all-electric house, and will have no chimneys or fireplaces. Doncaster will open a demonstration house on January 10th and, while it is open, it will be advertised by the Corporation in a main-street shop window. House-to-house distribution of cheque-coupons is being carried out, and campaign posters are being freely used in trams and omnibuses and public places, while direction signs are being posted up in various parts of the town. Yet another house in prospect is that at Hull, which is being got ready for opening on January 18th. Two semi-detached houses adjoining the power station at Sheffield are available for inspection by the public. The Wembley demonstration house is floodlighted in a striking manner, the lower red brick portion being illuminated with red light and the upper stucco part with white light. Contractors in the inner London area are being asked, in the course of personal visits by members of the campaign staff, to give greater prominence to the campaign in their windows. The number of electrical shops and showrooms is very small in relation to other trades, so that "100 per cent." support is essential to make an effective show. A successful three-day exhibition was recently held at Greenock; another one is to be held at Falkirk from February 7th to 11th. Exeter reports that £10 has been raised for the promotion of the campaign in that district. No. 6 of "Home Lighting News" was published last week. This contains the January window display suggestion; a list of towns with demonstration houses; appreciations of the campaign from supply authorities, &c.

After certain unavoidable delays, the all-electric demonstration house at Denton, Manchester, was opened on December 31st. The initiative in the matter was taken by an electrical contractor, Mr. Barratt, of Rusholme, who suggested to the Campaign Committee that if a demonstration house would be of use, he would arrange the matter with a local builder who was prepared to lend the property for the purpose, and further, to add to the attraction of the W.O.B. competition, he offered to any person within 20 miles of his premises who won the competition house a first-class radio outfit. Subsequently, with the aid of the builders, Messrs. J. Riley & Son, the house at Denton was equipped, furniture was supplied by Messrs. Philip Hart, Ltd., Manchester, and many leading manufacturers loaned electrical apparatus. After a brief speech by Mr. R. C. Hawkins, the district officer in charge of the campaign, the house was officially opened by Mrs. H. C. Lamb, the wife of the chief electrical engineer of Manchester. Mrs. Lamb is the moving spirit in the Manchester Branch of the Electrical Association of Women, and is assiduously working to further its objects. The Corporation is offering a special rate of 20 per cent. on the pre-war rateable value of the property or its equivalent, and in the case of this type of house the all-in tariff works out at about 12s. 6d. per quarter, plus ¾d. per kWh used. The house is to remain open from 2 p.m. until 8 p.m. until January 29th.

In the South Midlands Area there are indications that the second half of the campaign will be pushed with more vigour and enterprise than before. Two demonstration houses were opened at Walsall on January 1st, by the chairman of the Corporation Electricity Committee (Councillor J. Thickett, who was accompanied by the Mayor (Councillor J. A. Leckie), both of whom emphasised the tremendous advances made by the domestic application of electricity. The houses are well equipped for demonstrations, and they are being extensively advertised. Personal invitations to visit the houses have been sent out to a large number of householders by the local committee.

The Birmingham local committee will open its fifth demonstration house next week. This will be at Erdington, and a point worthy of note in connection with it is that it has been built by an electrical contractor.

The Birmingham Electricity Supply Department has distributed approximately 2,000 competition booklets, a number which is equalled by the Worcestershire, Staffordshire and Shropshire Electric Power Co., which is continuing its series of rural exhibitions in support of the campaign.

The "All-Electric House" at Lochfield Road housing scheme, Paisley, has proved such a success that arrangements have been made for another exhibition in a house of the bungalow type.

British Empire Chambers of Commerce.

The general arrangements for the eleventh congress of the Federation of Chambers of Commerce of the British Empire, which is to be held in Cape Town during the first week of October, 1927, are already well advanced. The Congress will meet under the patronage of the Earl of Athlone, Governor-General of the Union of South Africa, and the delegates will be entertained at a State banquet. A 25-day tour is being arranged by the Association of Chambers of Commerce of South Africa, with the assistance of the Union Government, in order that when the actual business of the Congress has been concluded the delegates may have the opportunity of visiting the principal cities and other points of interest. The president of the Federation, Lord Kylsant, will preside over the Congress sessions; he will be supported by Sir Edward Dawson, chairman of the Council of the Federation.

Frauds on Electrical Companies.

Two Bradford men, Walter Smith and Martin Hewitt, were sentenced to six months' hard labour at Sheffield last week on a series of charges, including one of obtaining by false pretences radio goods, value £33, from the Siemens and English Electric Lamp Co., Ltd., and another of attempting to obtain nine guineas' worth of goods from Metro-Vick Supplies, Ltd. It was stated by the prosecution that the men came to Sheffield at the beginning of December. Hewitt took a room as an office, had bills and an order book printed, and began business, stating that he was an electrical and wireless engineer; Smith acted as his assistant. The latter went to various electrical firms in Sheffield with orders signed "A. Walker," and, if possible, got the goods. Smith signed for the goods in the name of "W. Jones." His real name was not Smith, but Carroll. There was no trace at the office of any electrical business being carried on. Hewitt, giving evidence, said he intended to pay for the goods. He could buy foreign lamps at 8½d. each and sell them at 1s. 6d. If he had had time he would have paid for the goods out of the profits he would have made from the lamps.

Germans to Construct Moscow "Tube."

The Berlin correspondent of *The Times* reports that the arrangements for the construction of an electric underground railway in Moscow by German firms are now understood to be complete. The work is to be undertaken jointly by the Allgemeine Electricitäts Gesellschaft and the Siemens Bau-Union. The cost is estimated at some 200,000,000 marks (£10,000,000). Apparently the difficulties which arose between the municipal authorities of Moscow and the German contractors have been overcome and negotiations have been resumed with the American syndicate which was to have financed the greater part of the undertaking and which recently became restless at the delays and sought to withdraw. It is understood that under the arrangement now reached the Soviet Government, the municipal authorities of Moscow, and the German electrical firms will all have an interest in the railway when completed.

British Exports to Australia.

The Sydney (N.S.W.) correspondent of the *Daily Telegraph* says that the official statistics of foreign trade for the year ended June 30th last show a decline in the proportion of imports provided by Great Britain, including most of the principal manufacturing groups. The machinery group percentage has declined steadily from 62.5 per cent., pre-war average, to 53 per cent. in 1925-26. Compared with the year 1925 the percentage of iron and steel shows a decline of 3 per cent., electrical machinery 2½ per cent., and other machinery 2 per cent.

Australian Tariff Decision.

The Australian Tariff Board has decided that alternators and generators of over 75-kW, but less than 500-kW, capacity shall be classed under Item 174 provided security is given that the machines will be used only as generators in plant for the production of electrical energy.

Production Management.

An address on this subject was given by Mr. J. F. Marsden, F.S.S., F.C.W.A., at a recent meeting of the Business Research Association of Great Britain. Mr. Marsden touched upon some of the many considerations which a company or firm has to make before actually embarking upon production, as well as the procedure which should be adopted when production has commenced. In one part of his address he set forth a number of matters which had to be studied when choosing a site for a factory. Some of these were: The proximity of the site to sources of supply of raw materials and to the market for the finished product; labour supply in the district; transport facilities; the accessibility of the plant to workers; the accessibility of fuel or power supply; the availability of water for sanitation, processes, and fire protection; drainage; room for expansion; local taxation, &c. While urging that all the natural light available should be obtained, Mr. Marsden impressed upon the meeting the need for properly-designed artificial lighting.

A Christmas Showroom Window.

The illustration which accompanies this note is a view of the showroom of the Bexley Urban District Council's Electricity Department (engineer: Mr. A. J. Abraham). The

The Bexley Christmas Showroom Window.

appliances shown were put forward as suggestions for Christmas gifts, and both these and the lighting equipment were "Siemens" or "Siemens-Xcel" products.

Spanish Tariff Decision.

The revision of the commercial treaty between Spain and France last August affected Great Britain as the special rates existing before the revision were applicable to British goods. The Spanish Government intended to cancel the concession, but as the result of conversations the special rates are to be continued until April next, when it is Spain's intention to definitely withdraw them.

British Trade with Argentina.

Speaking at the recent annual meeting of the British Chamber of Commerce in the Argentine Republic, Sir Malcolm Robertson, the British Minister, as reported by the *Review of the River Plate*, said that British trade in Argentina appeared to be giving way to that of other countries. There were several reasons for that, but they could all be summed up in the statement that we did not study the market. In these days it was of no use waiting for people to come and buy unless a keen demand had been created by advertising. We had to go out and sell, using the language of the country. The market was worth studying for it was the most important of many similar markets in that part of the world. It was not much use trying to sell first-class goods at high prices when the majority of the people wanted goods of lesser quality and lower price. That did not mean the abandonment of the first-class standard and finish, but the production of lower-grade goods side by side with the others. Among other points which should be emphasised to the Argentine buyer was the fact that Great Britain was Argentina's principal customer. Orders lost meant less work in England which, in turn, meant a lower balance available for Argentine products.

The Sydney Contract Dispute.

We have already recorded that the Commonwealth High Court held that it was *ultra vires* the Australian Shipping Board to undertake a contract for the manufacture of steam and generating plant for the Sydney City Council. Recently the Court delivered its considered judgment in the matter, which was that the activities of the Board were confined by its Act to shipbuilding, owning, and repairing. The Chief Justice said that whatever the position might be in time of war, there was no doubt that the Board had no power to undertake external manufacturing and trading in time of peace.

Radio Apparatus for Australia.

A writer in the January *Broadcaster and Wireless Retailer* draws attention to the fact that out of £6,000,000 worth of radio goods imported into Australia during the last 3½ years only £700,000 worth came from Great Britain. He proceeds to state reasons for the Australian preference for American apparatus; briefly, these are as follows:—The American manufacturer gives better terms and aims to adapt himself to the Australian traders' requirements; better finish and packing characterise American goods; American models are more up-to-date, perhaps on account of the geographical position of the United States in relation to Australia; and prices are more favourable. Among actual examples quoted are accumulators. While it is agreed that the British types are good, it is held that they are wanting in appearance, and, moreover, are usually in celluloid cases, whereas hard rubber is preferred. Mention is also made of super-heterodyne kits, which are stated to be far heavier than the American patterns, which, in addition, are attractively got up. Two British companies, selling valves and loud speakers respectively, are congratulated upon the methods which they have adopted. The writer says that the Australians do not like the position, but, after all, they look for the best and are willing to pay for it.

Colonial Premier's Visit to Standard Works.

The Hon. J. C. Coates, M.C., Prime Minister of New Zealand, visited the Hendon factory of Standard Telephones and Cables, Ltd., last week, and inspected the new 5-kW broadcasting set recently manufactured there for installation at Wellington, N.Z. The apparatus was actually demonstrated, and Mr. Coates expressed his satisfaction with it. A model exchange, forming part of the new automatic telephone system for London, was also demonstrated, and Mr. Coates was shown many other aspects of the company's activities in the advancement of speech transmission.

German Instrument Companies Amalgamate.

With the title of the Zeiss Ikon Gesellschaft, a new company has been formed in Dresden to acquire and amalgamate the electrical and scientific instrument manufacturing businesses of the Cordessa-Nettel Co., Stuttgart, the C. P. Goerz Optische Anstalt Co., Berlin, and the Ica Co., Dresden.

Social Events.

The office staff and works employés of Messrs. Thorn and Hoddle, Ltd., held their annual dinner at the Old Colony Club, Aldwych, on Wednesday, December 29th, Mr. Albert Hoddle taking the chair. Some eighty members of the male sex were present, the ladies making their own party at the Coliseum. A musical entertainment provided a delightful termination to a very enjoyable evening.

The annual carnival dance of the staff and employés of the Automatic Telephone Manufacturing Co., Ltd., took place at the Grafton Rooms, Liverpool, on December 20th. There was a very good attendance, some 750 dancers taking the floor, and an excellent variety of costumes. Prizes were

Costumes at the A.T.M. Carnival Dance.

awarded to Miss Cairns, Mrs. M. Fisher, Mrs. J. Brown, Miss L. Brown, and Messrs. P. W. Jones, G. Allinson, M. Fisher, and E. Williams. These ladies and gentlemen are seen in the foreground of our illustration. Mr. G. W. Moore (manager of the company), assisted by Mrs. and Miss Moore, acted as judges, and Mrs. Moore presented the prizes.

The annual prize distribution of the St. James' Electric Rifle Club was held on December 23rd. The chairman (Mr. F. J. Walker) was supported by Sir A. B. W. Kennedy, F.R.S., and Messrs. O. M. Andrews and W. E. Rowland. Mrs. Andrews distributed the prizes, which included the "Walker" Cup (Mr. E. B. Powell), and the "Deane" cup and rose bowl (Mr. F. O. Andrews).

The Christmas parties organised by the employés of the Halifax Corporation Tramways and Electricity Departments, for their children, were brought to a close in Christmas week, when there was a gathering of 90 happy children at the fourth of the series. The functions took the form of a good tea, games, dancing, and performances by entertainers, with a visit by Father Christmas to distribute toys.

Midland Bank Maps.

The Midland Bank, Ltd., has just issued a new edition of the maps of its own branches and those of affiliated banks. They are folded and bound in a cover of pocket size. The principal map covers the whole of the United Kingdom, but there are also large-scale maps of Central London and of London and suburbs. The bank has 1,900 branches in England and Wales.

Direction-finder Installations.

The Marconi International Marine Communication Co., Ltd., reports further progress in the installation of Marconi direction-finding apparatus. Ships included in recent orders for equipment are six P. & O. liners, five New Zealand Shipping Co.'s liners, and 11 other vessels. The application of wireless direction finding to cross-Channel boats will obviate to a great extent the delays and uncertainty caused by the dense fogs and currents which are met with.

German Cables for Durban.

The *South African Engineer* says that the Durban Corporation has recently departed from its principle of buying British materials, in the matter of some telephone cables. The South African representative of a Berlin cable maker quoted a net price of £3,273 for material on which the lowest British offer was £1,268 higher. The interesting point emerges that another offer of German origin was but little less than the lowest British tender. "Under the circumstances, it is not surprising that in deciding to accept the lowest German bid, the various committees stipulated that the Corporation should have a representative at the factory to oversee the manufacture of the cable. This will absorb £200 or more of the saving, leaving roughly a difference of £1,000."

Modern Church Lighting.

The illustration herewith is a view of the interior of St. Mark's Church, Sheffield, which has recently been equipped with a modern lighting installation. The fittings and flood-lighting arrangement for the chancel were provided by Metro-Vick Supplies, Ltd. (Sheffield branch). The fittings include ten six-light pentagon fittings and two nine-light octagon (48-in. diameter) fittings, the other lighting being furnished by 36-in. diameter electroliers and single-light

St. Mark's Church, Sheffield.

brackets fitted with 75-W white-sprayed gasfilled lamps. The chancel is floodlighted with "Emvee" reflectors and 100-W gasfilled lamps. "Cosmos" lamps, "Emvee" switches and lampholders, and Glover's v.i.r. cable are used throughout. The contractors who carried out the work were Messrs. Marsh Bros., Fargate, Sheffield.

Italian Tariff Increases.

Under a recent decree certain increases in import duties were put into force on December 19th. Among the articles affected are vacuum cleaners for houses and buildings (portable types), threaded iron and steel tubes, and light-projecting apparatus and machines, with lenses or prisms and parabolic reflectors.

Local Exhibition.

GREENOCK.—An exhibition organised by the Corporation Electricity Department was opened on December 28th by Councillor Lemmon, convener of the Electricity Committee. All the latest electric lighting fittings, fires, and appliances were on view, while cooking demonstrations attracted much attention. Kinema films added to the brightness of the exhibition, which was visited by large numbers of citizens.

Australian Preference for British Goods.

We recently reported that the Commonwealth Government had directed its Tenders Board to give preference to goods made in the United Kingdom if such goods could not be manufactured in Australia. This direction has now been strengthened by a further one that, before foreign goods are considered, articles manufactured partly in the United Kingdom and partly in the Dominions should receive favourable attention.

New South African Tube Company.

A provisional agreement has been arrived at between Stewarts & Lloyds, Ltd., and the Union Steel Corporation (South Africa) for the formation of a company to be known as Stewarts & Lloyds of South Africa, Ltd. This company will undertake the manufacture of tubes at a works to be erected at Vereeniging, the steel for which will be provided by the Union Steel Corporation, and it will also take over the merchant business hitherto carried on by a subsidiary of Stewarts & Lloyds, Ltd.

The Japanese Electrical Industry.

In a recent report on Japanese conditions, the Kobe correspondent of the *Chamber of Commerce Journal* (London) says that force of circumstances has prevented a too radical pursuit of the retrenchment policy, and there have been some big foreign loans for productive enterprises, and this, while increasing indebtedness, has maintained prosperity, without imposing any inconvenient burdens. The electrical companies have been among the chief borrowers, and Japan has now some very big concerns manufacturing electrical machinery and fittings. It is mainly in high-power generation, where speeds are very high and metallurgical considerations are of the first importance, that machinery has to be bought abroad nowadays. The manufacture of power generators is naturally considered a very important matter, and though it has been usual to import all kinds of internal-combustion engines, there are promises of the early taking up of certain varieties of Diesel engines in the big dockyards..

Unemployment.

The total number of persons registered at the Employment Exchanges as wholly unemployed on December 20th was 1,309,700, as compared with 1,410,378 on December 13th, and 1,102,400 on December 21st, 1925.

Shop and Store Lighting.

The first Illumination Design Course of 1927, the twelfth of the series, will commence at the London Lighting Service Bureau on January 24th, when Mr. H. Girdlestone will lecture on "The Lighting of Shops and Stores." The lecture will be illustrated by several full-size windows and specimens of interior lighting.

Prices of Raw Materials.

Messrs. F. Smith & Co. report, January 4th:—Copper (electrolytic) bars, £64, 15s. dec.; ditto ditto sheets, no change; ditto ditto wire rods, £74, 15s. dec.; ditto ditto h.c. wire, 9 5/16d., 1/16d. dec.

Messrs. James & Shakespeare report, January 4th:—No change in the price of copper bars (best selected), sheet and rod; English pig lead, £29 15s., 15s. dec.

Messrs. Edward Till & Co. report, January 4th:—India-rubber, Para fine, 1s. 4½d., ¾d. to 1¼d. dec.

In their weekly report on the lead position, Messrs. James Forster & Co. stated (January 1st):—"There is little fresh to report. A fair demand from consumers has been experienced this week, but in spite of this prices have sagged. Cable makers are still as slack as ever, and there are no signs yet of any Post Office orders being placed."

Company Law Amendment.

A deputation from the Association of British Chambers of Commerce was recently received by Sir S. Chapman (Permanent Secretary) and Mr. E. R. Eddison (Comptroller of the Companies Department) for the Board of Trade. The object was to suggest amendments to the existing law relating to limited companies which had not been dealt with by the Government Committee which has recently reported upon the subject. Mr. H. Lakin-Smith said that the Committee had suggested the issue of a separate profit and loss account by companies, to be available only at the general meeting; the Association suggested that the facts should be available to all shareholders. Mr. F. P. Robjent dealt with the subject of prospectuses, and said that the Association proposed that fuller information should be given in the case of contracts between the company and vendors and intermediary vendors, to disclose the amount of promoters' profits. Mr. Eddison replied to the points raised, and expressed the Department's unwillingness to impose any restrictive requirements which would only burden the majority of companies which were honest concerns. Sir S. Chapman said that the Bill would probably be based upon the Committee's recommendations, and the Association would have the opportunity of arranging for amendments to be moved during the Committee stage.

For Sale.

Mr. H. J. Shaw will sell by auction on January 12th and following day, at 13, High Holborn, the plant and stock of a wireless condenser manufacturer, the stock of a wireless goods factor, &c. (See our advertisement pages to-day.)

Successful Carol Singing.

As in previous years, the Osram G.E.C. Musical Society's carol-singing party during Christmas week carried out a series of successful "raids" on behalf of the Infants' Hospital, Westminster, the Industrial Orthopædic Society, and St. Hubert's Cripple School, Hammersmith. Various residential districts in Hammersmith, Barnes, Kensington, &c., were visited, resulting in the collection of £36, which has been divided equally between the three institutions mentioned. The party, with a specially illuminated "Osram" delivery van, proved a great attraction, and Mr. E. G. Gant, the conductor, is to be congratulated upon the results.

Failures in 1926.

A summary published by *Stubbs's Weekly Gazette* shows that the total number of failures in the United Kingdom in 1926 was 7,179, as compared with 7,916 in 1925. In England the total number of receiving orders and deeds of arrangement was 6,180, as against 6,768 in 1925; the total liabilities fell from £6,432,782 to £4,686,261, and the total assets from £2,166,553 to £1,972,989.

Important Birmingham Power Station Contract.

We are informed by Mr. R. A. Chattock, City Electrical Engineer, Birmingham, that his Committee has placed a contract with International Combustion, Ltd., for the erection and equipment of a new power station at Hams Hall, at an approximate total cost of £1,435,850. The contract provides that the electrical section, comprising turbo-alternators, condensing plant, and switchgear, shall be let as a sub-contract to the General Electric Co., Ltd., Witton, Birmingham.

Advertising Electric Cooker Hire.

The JACKSON ELECTRIC STOVE CO., LTD., has produced an adhesive stamp depicting one of its cookers and bearing the sentence "Hire Jackson Electric Cookers." These are being provided to electricity supply authorities who use the company's cookers for their hiring schemes.

West Midlands Industrial Council.

The annual meeting of the West Midlands Joint Industrial Council for the Electricity Supply Industry was held last week at Birmingham, and there was a full attendance of representatives from Warwickshire, Worcestershire, and Staffordshire, and from the six trade unions which are affiliated to the Council. Alderman A. G. Ellaway, Birmingham, was elected chairman, and Mr. Dempster, A.E.U., vice-chairman. Mr. E. J. Jennings, of the Birmingham Electric Supply Department, was cordially thanked for his services during the past year, and was re-elected secretary and treasurer.

The Belgian Telephone System.

The telephone question in Belgium now seems to be gradually approaching a solution. Two schemes are under the consideration of the Government. One is to establish a national company similar to the railway company, and the other is to transform the existing undertaking into an autonomous concern. A considerable sum is expected to be expended in developing communication with other countries, and Belgian cable makers have offered to grant credit facilities if they are given consideration in connection with the allocation of the orders for the cables. It is reported that the Ministry of Posts and Telegraphs has placed in Germany part of a large order for cables. The A.E.G. is said to have received orders of the value of 1,006,500 Belgas, and the Felten and Guilleaume Company one of 160,000 Belgas.

Trade Announcements.

Further to the note in our issue of December 24th, the FULLER ACCUMULATOR CO. (1926), LTD., advises us that it has now completed the improvements in the lay-out of the factory, which have greatly increased the manufacturing output, and the company is in a position to deliver from stock all standard types of batteries for wireless work and automobile starting and lighting. Stationary battery deliveries have also improved.

The NORTH METROPOLITAN ELECTRIC POWER SUPPLY CO. has opened showrooms in High Street, Hoddesdon, and an all-electric exhibition flat has also been opened.

MESSRS. ANDERSEN, MEYER & CO., LTD., engineers, contractors, and importers, whose head offices are at Shanghai, have opened London offices at 30, Mincing Lane, E.C., where Mr. S. H. Morden, lately general manager to Messrs. J. Whittall & Co., Ltd., will be in charge.

MR. G. R. ALLEN, radio engineer, of Aldershot, has removed to larger premises at 156, Victoria Road.

THE BEKO LAMP CO., LTD., has removed to 5, Finsbury Square, E.C.2. Phone: "Clerkenwell 7346."

B.K.B. ELECTRIC MOTORS, LTD., has removed to 200, High Holborn, London, W.C.1. Telephone No.: "Museum 4265."

THE NEW PELAPONE ENGINE CO., LTD., are now in occupation of their new factory at Lofthouse Gate, Wakefield.

New Catalogues and Lists.

MESSRS. HOPKINSONS, LTD., Britannia Works, Huddersfield.—List No. 1,880, describing the company's patent "Mac" valves for steam pipes.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram Bulletin" for December, containing notes and articles on "Osram" lamps, "Magnet" domestic appliances, and "Gecophone" radio apparatus.

INTERNATIONAL COMBUSTION, LTD., Africa House, Kingsway, W.C.2.—A well-produced brochure describing the "Lopulco" pulverised fuel system. Fully illustrated.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, W.C.2.—Leaflet No. 1,022-3, illustrating and describing Marconi magnetic drum recorders, Types 193 and U.g.4.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—A mailing card bearing a map indicating the situation of the company's service depôts.

THE CANADIAN PORCELAIN CO., LTD., Hamilton, Ont., Canada.—Catalogue 403, a pocket catalogue containing illustrated details of the company's insulators for indoor and outdoor service. The publication measures only 2¾ in. by 4¾ in. (approx.), and has 91 pages.

THE WALKER ELECTRICAL SERVICE, Annandale Street, Edinburgh.—A folder illustrating and describing the firm's motor and generator repair service.

MESSRS. F. A. WILKINSON & PARTNERS, LTD., Gretton, near Kettering.—An illustrated and priced pamphlet describing the company's wind-dynamo installations. A new type is noted. This embodies a 100-W, 12/14-V generator with a specially-designed switchboard.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—January blotter, with a view of Old Heidelberg, advertising "Hart" batteries with non-corrosive terminals.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—January blotter advertising "Elasta" electric lamps.

THE NORMAND ELECTRICAL CO., LTD., 3, North Side, Clapham Common, S.W.4.—An illustrated folder containing details and prices of small geared motors, motor-generators, sirens, and grinders.

THE NATIONAL GAS ENGINE CO., LTD., Ashton-under-Lyne.—Catalogue No. 255, describing in some detail the company's vertical heavy-oil engines. Fully illustrated.

Bankruptcy Proceedings.

N. H. PAYNE, 4, The Triangle, Teignmouth, late of Dawlish, electrical and wireless engineer.—The first meeting of creditors was held recently at the Official Receiver's office, Exeter. The statement of affairs showed ranking liabilities of £798, against net assets of £560, leaving a deficiency of £238. Debtor attributed his failure to having no free capital to enable him to tide over the period of long-term credit which he was obliged to give most of his customers, and to his liabilities being considerably increased by suing creditors. He commenced business at Teignmouth in January, 1925, without capital. Two months ago he borrowed £45 from his father and his brother as surety for a bank overdraft. In September, 1925, he opened a branch at Dawlish under a manager. He estimated the turnover for the whole period of trading at £3,050, with a gross profit of £1,220, against which he placed trade expenses estimated at £1,103. He did not become aware of his position until he filed his petition, and maintained that if creditors had given him time to complete work that he had in hand and in prospect he could have overcome his financial difficulty. The following are creditors:—

	£		£
Agra Engineering Co., Ltd.	27	Bankers	21
British Thomson-Houston Co., Ltd.	28	Metro-Vick Supplies, Ltd.	23
Burris, Fred., & Sons ...	58	Park Wholesale Co., Ltd.	22
Capel, P.	36	Priestley & Ford ...	76
Drake & Gorham Wholesale, Ltd.	22	Payne, H. W. H. ...	45
Falk, Stadelmann and Co., Ltd.	37	Simpson, Baker & Co. ...	42
General Electric Co., Ltd.	63	South Wales Wireless Installation Co., Ltd.	26
Houghton-Butcher (Gt. Britain), Ltd.	60	Siemens & English Electric Lamp Co., Ltd. ...	28
		Sun Electrical Co., Ltd.	38

The public examination was fixed for January 11th, to take place at Exeter.

H. A. MILLS, electrical engineer, &c., 1, Lorne Villas, Old Windsor.—Receiving order made December 21st on debtor's own petition.

J. R. PEET, electrical engineer, "Earsdon," Linden Walk, Prestatyn.—First meeting held December 31st at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester. Public examination, January 28th, at the Court House, Bangor.

J. R. CHARNOCK, cycle dealer and electrical engineer, 6, Stonegate Road, and Meanwood Road, Meanwood, Leeds.—Last day for proofs for dividend, January 10th. Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds.

H. H. ATKINSON, electrical engineer, 33, Princess Avenue, Old Trafford, Manchester.—First and final dividend of 10s. 1d. in the £, payable at the Official Receiver's office, Byrom Street, Manchester.

D. T. DONOVAN and H. A. LANGLOIS (London Electrical Co.), 119, St. Mary Street, and 124, Queen Street, Cardiff.—First meeting held to-day at 34, Park Place, Cardiff; public examination February 11th, at the Law Courts, Cathays Park, Cardiff.

A. J. CULLUM, motor and electrical engineer, 34, Mount Pleasant, and 8, Church Street, Diss.—First meeting held January 7th, at 9, The Arcade, Ipswich; public examination January 14th, at the Shirehall, Ipswich.

W. H. DICKSON and A. J. SOLOMON (trading as Dickson and Solomon), radio engineers, 13 & 14, Tavistock Street, Devonport.—A meeting of creditors was held at Devonport

on December 31st. The gross liabilities were stated to be £390, and the debtors attributed their failure to the depression in trade and the heavy rental which they had been obliged to pay. The case remains in the hands of the Official Receiver.

Company Liquidations.

CLEAR HOOTERS, LTD., electric horn manufacturers, Birmingham.—A meeting of creditors was held recently, at the Birmingham Chamber of Commerce. Mr. L. J. S. Austin, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs which disclosed liabilities of £6,133 and net assets of £1,126, leaving a deficiency so far as the creditors were concerned of £5,007. The liquidator, on behalf of the directors, submitted a scheme of reconstruction, under which it was proposed that creditors for sums of £30 and upwards should accept 5 per cent. third debentures in a new company in full settlement and discharge of their claims. These would be irredeemable for three years, except at the option of the company, and would be subject to first debentures of £2,200, and to second debentures of £1,000. Creditors whose claims amounted to £5 and upwards to £30 were given the option of either accepting third debentures or a composition of 4s. in the £, payable within two months of the completion of the scheme. Creditors whose claims did not amount to more than £5 were offered the latter alternative. The scheme was accepted, and an advisory committee was appointed consisting of Messrs. J. M. Dunkley (Callender's Cable & Construction Co., Ltd.), H. Harley (Coventry Gauge and Tool Co., Ltd.), and N. R. Nicholls (Birmingham Products, Ltd.).

FARRINGDON ELECTRICAL CO., LTD.—Winding up voluntarily. Liquidator, Mr. A. B. Neil, 22, Queen Street, E.C. A meeting of creditors was held on January 4th, at 22, Queen Street. Particulars of claims to the liquidator by February 28th.

NATIONAL WIRELESS CORPORATION, LTD.—Winding up order made by the High Court on December 21st, 1926.

GWYNNES ENGINEERING CO., LTD.—First meetings of creditors and contributories were held at Carey Street, W.C., on January 5th.

TELE DIS SERVICES (FOUNDERS CO.), LTD.—Liquidator, Mr. G. D. Pepys, Official Receiver, Carey Street, W.C., released December 20th, 1926.

Private Arrangements.

MELROSE & DOW, ironmongers and electrical engineers, Main Street, Callander.—At a recent meeting of creditors it was resolved that Messrs. Galbraith, Glasgow, should prepare trading accounts, a profit and loss account, and a deficiency statement. It was further resolved that, failing the submission of a proposal approved of by the committee of creditors, the debtors' affairs should be realised under a trust deed in favour of Mr. W. B. Galbraith, in the meantime the business to be carried on in the interests of the creditors. A committee representing creditors was appointed to advise in the event of the estates being realised under the trust deed, &c. The statement of affairs as at December 15th showed total liabilities of £2,726 and net assets of £825, leaving a deficiency of £1,901. The following are creditors:—

	£		£
Baxendale & Co., Ltd. ...	33	North British Machine Co., Ltd.	71
Blundell, Spence & Co., Ltd.	20	M. Nairn & Co., Ltd. ...	36
T. Black & Son	27	T. Rowatt & Son ...	44
Cauldon Potteries, Ltd.	20	Remington Arms, Ltd.	24
Crowden & Keeves, Ltd.	39	T. Scott & Co., Ltd. ...	80
Croggon & Co., Ltd. ...	50	Scottish Oil Agency, Ltd.	21
Cathro & Roger, Ltd. ...	24	A. Sharp & Son	24
Falkirk Iron Co., Ltd.	32	Smith & Wellstood, Ltd.	39
Graham & Morton, Ltd.	45	Spence & Gerrard, Ltd.	67
Gardner, John	35	J. Shaw & Sons, Ltd. ...	23
W. Glen & Son	22	Thomson & Williamson, Ltd.	23
General Electric Co., Ltd.	32	Ferrier, James, & Son	21
Jellyman & Sons, Ltd.	24	Macintosh, Hugh ...	53
Lewis, W. & R.	22	Anglo-American Oil Co., Ltd.	38
Martinet, Nicolas ...	27		
W. McGeoch & Co., Ltd.	61		

Dissolutions of Partnership.

MASON & MARSHALL, cycle, motor-cycle and motor-car engineers, electrical engineers, and dealers in wireless sets and accessories, 11, Manor Parade, Stamford Hill, N.—Messrs. C. H. Marshall and C. E. Mason have dissolved partnership. Mr. Mason will continue the business.

J. MANNING & CO., electrical engineers and contractors, 27, Leek Street, Birmingham.—Mr. J. Manning and Mr. L. V. Hamblin have dissolved partnership.

Calendars and Diaries.

We are indebted to a further number of friends in the industry for their compliments and good wishes for 1927.

MESSRS. DAVIDSON & CO., LTD., of Sirocco Engineering Works, Belfast, have issued a card, entitled "Trade Winds," with a coloured view of "The Cutty Sark" in full sail, suggesting a spirit of optimism and a hope that trade in the New Year will eclipse all previous records.

To a card advertising "Elasta" lamps, and issued by POPE'S ELECTRIC LAMP CO., LTD., of 5, Arthur Street, New Oxford Street, London, W.C.2, is affixed a set of monthly 1927 calendar sheets.

MESSRS. DOWNES & DAVIES, Liverpool, have chosen a water-colour reproduction of a pretty girl with rather reproachful eyes as the subject of their 1927 calendar.

The calendar of the DAVENPORT ENGINEERING CO., LTD., Bradford, is a businesslike production bearing a view of some cooling towers and a block of black-upon-red daily slips.

The calendar of Messrs. FRANCIS POLDEN & CO., LTD., Cannon Street, E.C.4, is again equipped with a date-marking device which adds to its usefulness. The company has also sent us, as in previous years, one of its pocket diaries, which is really an excellent production. It has a folding-over leatherette case and four-day pages with ample memoranda space.

Barribal's "Exide Girl" again appears upon the 1927 calendar of the CHLORIDE ELECTRICAL STORAGE CO., LTD.

THE LONDON UNDERGROUND RAILWAYS CO. has sent us an interesting desk calendar, each tear-off sheet providing for one week's memoranda, and bearing a picture representing some notable feature of the railway system, a view in the district which it serves, or a person or incident associated with London or with its famous "Underground."

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2, has sent us a block of daily slips for 1927 to replenish its metal calendar.

We have again received from the KEY ENGINEERING CO., LTD., Trafford Park, Manchester, its pocket calendar, which is a celluloid strip bearing the full 1927 calendar, with English and metric measures on the edges.

MESSRS. W. H. WILLCOX & CO., LTD., have issued a businesslike "date remembrancer" comprising monthly sheets with illustrations of the company's packings, steam fittings, pumps, tools, lubricants, &c.

Bold-figured monthly sheets and illustrations of work carried out by the firm are the main features of a calendar received from the WALKER ELECTRICAL SERVICE, Edinburgh.

The "Orion" pocket diary for 1927 has been received from ORION LAMPS, LTD., 15-17, Eldon Street, E.C.2.

Our desk will be brighter all through the year because of the presence thereon of a metal calendar with ingenious date-changing device, received from Messrs. CRYSELCO, LTD., of Kempston Works, Bedford. Upon the metal case is engraved the impressively uniformed "Col. Chris. Elco," of the "Cryselco Light Brigade."

THE IRON & NICKEL BATTERY CO., LTD., of 17-19, Cockspur Street, London, S.W.1, has prepared for its friends a 10-in. advertising ruler, and will send one to any reader who makes application.

A neat vertically-opening vest-pocket book with squared memorandum pages has been received from the TUNGSRAM ELECTRIC LAMP WORKS, LTD., 72, Oxford Street, W.1.

The architecture of mediæval Chester has again been drawn upon by BROOKHIRST SWITCHGEAR, LTD., for its 1927 desk calendar. The prints are sepia on parchment, and are enclosed in a neat moulded black frame. The business side has been reduced to a minimum, and the beauty of the calendar is thus preserved.

MESSR. B. S. & W. WHITELEY, LTD., of Leeds, have again issued to their friends a wall or desk calendar bearing a block of daily slips with literary quotations.

From the S.E.A. Co., LTD., of Lichfield Street, Hanley, we have received a wall calendar with a picture of three "Kennel Companions" printed in appropriate colours.

Chinese Notes.

An electric power supply company has been organised at Kulangsu, Amoy (Fukien province). It has a capital of $250,000 (national currency).

The Superintendent of Telegraphs in the eastern provinces of Manchuria has closed down a number of telegraph offices which have been rendered superfluous by the growth of telephone communication.

Following upon the increasing of fares by the other Shanghai tramway companies, the Chinese Tramway Co., Nantao, has decided to do the same.

Book Notices.

"The Colliery Managers' Pocket Book, 1927." Pp. 520+cxxvii; illustrated. Edited by J. Vincent Elsden, D.Sc. London: The Colliery Guardian Co., Ltd.—This 58th edition maintains the policy of the work to assist the mining engineer in his daily routine, and the student who aspires to fill a managerial position in his preparation for such duties. The book opens with the usual chapter on Mining Progress during the past year, and includes a summary of the findings and recommendations of the Report of the Royal Commission on the Coal Industry. A valuable feature of the volume is a selection of statistics which are claimed to be completely up-to-date. The staple sections of the book, including Coal and its By-Products, and Electricity in Mines, have been thoroughly revised, while other sections, including winding and haulage, have been re-written by acknowledged experts.

"Marconi's International Register of Telegraphic and Trade Addresses, 1926-7." London: Marconi International Code Co., Ltd. Price 27s. 6d., carriage paid.—The principal change effected in this bulky directory is in the price, which represents a reduction of nearly 50 per cent. The volume contains the names and addresses of over 55,000 of the world's leading manufacturing and trading concerns in alphabetical order. The Classified Trades Section gives exhaustive lists which will be of service to both buyers and sellers. Another

important section is an international list of cable addresses. The Register should prove invaluable to all firms who are interested in overseas trade.

"The Electrical Engineer's Year Book, 1927." Edited by J. H. Johnson, M.I.E.E. (Pp. 508+diary.) London: S. Davis & Co. Price 21s., post free.—This is the nineteenth edition of a work which covers in an admirable manner all phases of electrical engineering—generation, distribution, contracting and manufacturing, as well as selling. The matter has been brought up to date, but the general scheme is similar to that of previous editions.

"Optical Instrument Catalogue." Pp. 336, quarto; fully illustrated, paper covered. London: The Optical Convention. Price 6s. net.—The exhibition to which this catalogue relates was held in connection with the Optical Convention, 1926, and the book is intended as a permanent work of reference to British optical manufactures at the time of the Convention; containing full illustrated descriptions of the instruments and apparatus exhibited by the leading makers in Great Britain, it is indispensable to all users of optical appliances. Descriptions of the experimental and research and historical exhibits at the Convention are also given.

"Proceedings of the Optical Convention." Part I, 512 pages; Part II, 578 pages. Fully illustrated, with plates and figures in the text. Price £3 net.—These two quarto volumes, bound in cloth, contain the full text of the presidential address and of the papers (numbering nearly 100) read at the Convention, together with a report of the discussions and of certain special lectures which were delivered. The publication constitutes a record of progress since the last Convention, in 1912.

From the Cripplegate Institute, Golden Lane, Barbican, E.C.1, we have received a 36-page booklet containing a programme of winter, spring, and summer courses, lectures, entertainments, &c., held at this increasingly popular City institute.

"The *Wireless Trader* Year Book and Diary, 1927" (pp. 215+clxiii). London: The Trader Publishing Co., Ltd. Price 5s. 6d., post free (7s. 6d. overseas).—This is the third edition of this useful wireless directory, and a number of new features are embodied in it. In addition to a great deal of technical and legal matter, the year book contains an ample diary, directories of traders, and proprietary names, and a section devoted to short reviews of books upon radio theory, experiment and construction. A section of particular interest to exporters is that devoted to tariffs imposed by Dominion and foreign Governments upon radio apparatus.

"Science Abstracts" (A. & B.). Vol. XXIX. December 25th, 1926. Part 12. London: E. & F. N. Spon, Ltd. Price 3s. each.

A Siemens-Schuckert Acquisition.

According to the *Financial Times* correspondent at Berlin, the Siemens-Schuckertwerke concern has taken over the National Automobil Gesellschaft, which manufactures automobiles and motor lorries.

Unemployment in France.

According to statistics prepared by the French Minister of Labour the number of French unemployed does not exceed 10,000 in Paris and 30,000 in the departments.—*Reuter* (Paris).

Lighting and Power Notes.

Amesbury.—SCHEME APPROVED.—The Rural District Council has given its consent to an application by the Durrington Electricity Supply Co., Ltd., for an Order to supply electricity in the parishes of Durrington and Bulford.

Aughton (Lancs.).—ELECTRICITY SCHEME.—Mr. G. P. Shallcross, formerly electrical engineer to Birkenhead Corporation, has prepared an electricity scheme, estimated to cost £14,000, for the Parish Council. The Council has decided to approve of the scheme, subject to the requisite number of consumers being obtained, and it will be submitted to a meeting of ratepayers to be held shortly.

Australia.—VICTORIA.—According to the *Electrical Engineer of Australia and New Zealand*, the seventh annual report of the State Electricity Commission, covering operations for the year ended June 30th last, reveals a considerable expansion of the Commission's services and distinct improvements both as regards the technical problems and the financial position of the undertakings. The amount of energy sold during the year was 161,990,327 kWh, as against 101,000,000 kWh in the previous year. The Yallourn power station and the plant at the briquetting factory generated 142,678,586 kWh, while the Newport B power station produced 46,031,164 kWh. The maximum demand on Yallourn was 36,000 kW and that on Newport B was 16,800 kW. A tabulated statement dealing with all generating authorities in the Melbourne metropolitan area shows that the total amount of energy generated for all purposes, including electric railways, was 463,000,000 kWh, as compared with 419,500,000 kWh in the preceding year. The *per capita* consumption of electrical energy was 503 kWh, as against 489 kWh and, excluding railway traction, the respective *per capita* consumptions were 335 kWh and 314 kWh. The total loss on the whole of the operations during the year was £262,000. The total revenue from the electric supply operations was £713,252, and the expenditure, including interest, amounted to £937,931, making a loss of £224,679. The loss on electric supply last year was £240,944. The briquetting operations resulted in a loss of £36,257, as compared with £39,925 last year.

Bolton.—INCREASED CHARGE REMOVED.—Increased electricity charges imposed by the Electricity Committee three months ago through the high cost of coal are to be removed.

Brazil.—SAO PAULO.—The Sao Paulo Power Co. has completed its new hydro-electric station at Cubatao. The two turbo-generators of this new plant are each of 40,000 h.p., and are said to be the largest yet constructed of this type. It was expected that the plant installed at the end of 1926 to meet the demand for electricity in Sao Paulo would have a capacity of 228,000 h.p.

Chesterfield. — LOANS. — The Electricity Committee is to apply for sanction to the following loans:—£48,700 for mains and services; £1,075 for the provision of transformer sub-stations; £12,000 for further hired wiring installations; £10,000 for meters; and £8,240 to cover amounts already spent on mains, services, meters, &c.

PROGRESS OF SUPPLY.—The Engineer (Mr. D. H. Davies) has reported to the Committee that applications for supply are being received in such large numbers that at the present rate all the available householders in the town would be taking a supply in the next five years.

PRICE REDUCTIONS.—Despite the coal dispute, the charges for lighting and large power purposes were reduced by 10 per cent., in March and July last, respectively.

Continental.—CZECHO-SLOVAKIA.—According to *Commerce Reports*, plans for the electrification of eastern Czecho-Slovakia were recently formulated in Kosice. The manager of the electrical works at Presov has suggested the erection of a central hydro-electric station on the banks of the Poprad river, where there is a fall of 65 metres, which could develop 6,000 h.p. The projected station will be the first plant of the proposed system to be known as the Eastern Slovak Electric Power Works. The Government will finance a part of the work, and the interested municipalities will contribute large sums, in accordance with the electrification law. The central power station will supply electricity to Presov and by way of Kezmarok to Levoca. On completion of this station an electric railroad will be constructed from Podelin to Luboteny in order to connect this part of the Poprad valley with the Slovak railway system.

SWEDEN.—The Stockholm correspondent of *The Times Trade and Engineering Supplement* reports that at the State hydro-electric works at Lilla Edet and Norrforsen, near Umea, 60,000 additional h.p. is now available, while works have been commenced near Hammersfors which will produce another 27,000 h.p. The total amount at present available is estimated at 1,400,000 h.p., as compared with 885,000 ten years ago.

Dundee.—EFFECT OF COAL STRIKE.—It was reported at a recent meeting of the Corporation Electricity Committee that the loss sustained by the Department as a result of the coal strike was £24,000. An effort is to be made to avoid a continuance of the 10 per cent. increase in price by resorting to the reserve funds.

East Anglia.—ELECTRICITY BILL.—The East Anglian Electric Supply Co. has deposited a Bill for next session, under which statutory power is sought to supply electricity within an area comprising the whole of the counties of Norfolk, Suffolk, and a large part of Essex. The company, which is already supplying electricity in these counties, is to submit to the Commissioners proposals for the development of the supply. These proposals are to be carried into effect within the time prescribed by the Commissioners, but if within three years from the passing of the Act the company has not, in the opinion of the Electricity Commissioners, substantially commenced its works for the purpose of carrying out its powers, the Minister of Transport may order the powers to cease as to the whole or any part of the area of supply.

Eastbourne.—NEW RING MAIN.—The Electricity Committee has approved an estimate of £22,834 for the proposed new ring main.

Japan.—KOBE.—*Eastern Engineering* states that the Municipal Electric Bureau's application for sanction to extend its steam power plant for generating electricity has been rejected by the Communications Department on the score that the Bureau's present plant, capable of generating 26,000 kW, is sufficient in view of the supply of hydro-electric power of 15,000 kW by the Ujikawa Electric Power Co. The Communications Department does not encourage the increase of steam power from the point of view of national economics, preferring that hydro-electric power be obtained.

Lyme Regis.—LOAN.—The Town Council is to obtain sanction to a loan of £16,065 for electricity purposes.

Newark-on-Trent. — CONSULTING ENGINEER. — The Town Council has appointed Mr. R. W. Willis as consulting engineer for the electricity undertaking at a retaining fee of 100 guineas per annum, plus expenses.

Northern Ireland.—Co. ANTRIM.—Fearing that the proposed electrical schemes in the county would be detrimental to the inland fisheries of the River Bann, the Coleraine Board of Fishery Conservators has appointed a deputation to place its views before the Bann Drainage Advisory Committee.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

HAMILTON.—An increase of 5 per cent.

RADCLIFFE.—An increase of 10 per cent.

Rawtenstall.—NEW PLANT.—The Corporation is to install an additional 6,000-kW turbo-generator at its generating station. The new plant will enable it to double its present output of electricity.

Rugby.—WIRING OF SMALL HOUSES.—The Urban District Council has adopted a scheme, submitted by the Electric Lighting Committee, for the wiring of its houses on the deferred payment system.

St. Helens (Isle of Wight).—STREET LIGHTING.—The Urban District Council has sealed a three-years' contract with the Isle of Wight Electric Light and Power Co., Ltd., for public lighting.

South-East Lancashire Electricity Advisory Board.—NEW STATION AT KEARSLEY.—In connection with the proposal of the Lancashire Electric Power Co. to erect a new power station at Kearsley, the Engineering Advisory Committee has received replies from Manchester, Oldham, and Salford Corporations to its inquiry as to whether they would be willing to extend their stations in order to meet the demands of the company, and if so, the terms upon which they would give such a supply. As no terms have been quoted by the three Corporations for bulk supplies as alternatives to the company's proposal, the Board has resolved that it is in the interests of the district that the proposal of the company for the erection of a new station at Kearsley should be carried out and that the Board be recommended to approve it.

MACCLESFIELD.—The Committee has received intimation that the Electricity Commissioners have sanctioned the installation of a 400-kW d.c. oil-driven set at the power station of the Electricity Company of Macclesfield, Ltd.

CHAPEL-EN-LE-FRITH AND DISTRICT.—The Engineering Advisory Committee has recommended the Board to support the application of the Power Development Co., Ltd., for a Special Order authorising it to supply electricity in the above area.

WIGAN.—The Committee has also recommended the Board to support the application of Wigan Corporation for a Fringe Order to supply electricity to the works of the Haigh Dyeing Co., Ltd., Haigh, subject to the approval of the Lancashire Electric Power Co. and Wigan Rural District Council.

The minutes of the proceedings of the Engineering Advisory Committee have been approved by the Board.

Staveley.—ELECTRICAL DEVELOPMENT.—The development of the h.p. electrical system of the Staveley Coal and Iron Co., which serves not only that company's works and collieries, but several Derbyshire villages and a part of Chesterfield, has necessitated the installation of a second very large gas engine at that company's Derbyshire works generating station. It is intended in due course to erect a third engine of this type at the Devonshire works.

Stirling.—ELECTRICITY SUPPLY.—Application is to be made by the Town Council to the Scottish Midlands Electricity Supply Co., Ltd., for its terms for supplying electricity to supplement the supply generated at the power station.

LOAN SANCTIONED.—Sanction has been received to a loan of £2,050 for mains and services.

Tring.—INAUGURATION OF SUPPLY.—An electricity supply for the district was recently formally inaugurated by the vice-chairman of the Urban District Council. The supply is obtained from Aylesbury Corporation.

York.—NEW BOILER PLANT.—The city electrical engineer has reported upon the question of raising the boiler steam pressure, and the Electricity Committee has recommended to the Corporation that three boilers and an economiser be removed, and one 36,000-lb. and one 18,000-lb. boilers with chimney, feed pumps, economisers, steam piping, &c., be installed, which would increase the boiler steam capacity by 54,000 lb., or 3,850 kW, making a total of nearly 13,000 kW. The estimated cost of the scheme is as follows:—Removing old boilers and economisers, fitting new boilers, chimney, &c., £19,500; reloading and adjusting existing boiler safety valves, £80; fitting new nozzles to the two 3,500-kW turbines, £500.

PRICE REDUCTION.—The committee has decided to reduce the charge for electricity by ¼d. per kWh as from the December quarter meter readings.

Wolverton.—ELECTRICITY SUPPLY.—At a recent meeting of the Urban District Council, the clerk reported that in reply to an inquiry made to the Northampton Electric Light Co. as to the price of electricity, he had received a reply from the company to the effect that when the overhead mains had been constructed and sufficient consumers were connected to wipe out the present loss in giving a supply to Wolverton, the price of electricity would be considered. It was decided to ask the Ministry of Transport to withhold consent to the erection of overhead cables until the Council received a satisfactory answer as to the cost of electricity.

Tramway and Railway Notes.

Australia.—ADELAIDE.—The report of the Municipal Tramway Trust (manager: Mr. W. G. T. Goodman) for the year ended July 31st last shows a total income of £629,394, as compared with £609,202 in the preceding year. Working expenses amounted to £446,791, as against £443,081, leaving a gross profit of £182,603 (£166,121). After deducting capital charges, there was a net deficit of £62,304, as compared with a deficit of £67,457. There was also a loss on the Port Adelaide tramway and motor-'bus systems, making a total deficit for the year of £89,958. The number of passengers carried increased from 59,663,457 to 62,562,249, and the car miles run from 6,860,256 to 7,021,400. During the year the power station at Port Adelaide, which supplies the energy for the tramways, was extended by the addition of a 10,000-kW turbo-alternator.

Continental.—ITALY.—Work is about to be commenced on the electrification of the railway between Chiasso, on the Italian-Swiss frontier, Milan and Voghera. Good progress has been made with the electrification of the railway between Florence and Bologna, and electric trains are about to be put in operation between Bologna and Pistoja. The necessary electricity is to be supplied from two hydro-electric stations in Tuscany.

Glasgow.—SUPPLY FOR TRAMWAY.—Hitherto the supply of electricity for the Corporation tramway has been drawn from the Tramway Department's own station at Pinkston, but consideration is now being given to a proposal for taking the necessary supply from the new Corporation station at Dalmarnock, thus bringing about a unification of control throughout the city.

Japan.—RAILWAY ELECTRIFICATION.—The scheme for electrifying the railways of Japan is receiving renewed attention. According to *Eastern Engineering*, under the present programme, the electrification of the line between Numadzu and Akashi, a distance of 378 miles, is to be carried out at the estimated cost of y. 7,777,000 in five years, from the next fiscal year, but it is now considered that the money appropriated for the purpose is hardly sufficient. As, on the other hand, it is out of the question for expenditure to be increased, in view of the dwindling railway revenue in recent years, the view is finding support that the proposed work should either be abandoned or postponed. As regards the Chuo line, it is proposed that electrification between Tokyo and Hachioji be completed by the end of the fiscal year 1928-29, while the electrification work on the line between Hachioji and Kofu is also to be started either during the next fiscal year or on the completion of the electrification of the line between Tokyo and Hachioji. So far as the electrification of lines in the suburban districts of big cities is concerned, work will proceed according to programme.

London.—SLOANE SQUARE STATION.—Sloane Square station will be the first District Railway station to be equipped with an escalator for its own traffic. All other stations which have escalators connect with deep-level tubes. The new escalator is to be an ascending one from the westbound platform to the street level, with an intermediate landing for eastbound passengers, and its construction forms part of a general scheme of reconstruction at this important station. The other improvements include the complete rebuilding of the booking hall and entrance to the station, and the installation of two booking booths which will take the place of the existing "hole-in-the-wall" method of booking. The new station will resemble closely the new Morden line stations, and will include a scheme of floodlighting.

HIGHGATE TUBE STATION.—To enable the traffic to be dealt with more expeditiously, the four lifts at Highgate tube station are to be superseded by comb-type escalators. Work will begin shortly, and it is hoped that the improvements will be complete by next summer. When the escalators are installed, the lifts will be dismantled and the space they occupy devoted to the formation of a larger booking hall, which will facilitate a freer movement of traffic entering and leaving the station. Passimeter booking booths will replace the existing booking office. The escalator will maintain a continuous service throughout the day and be able to deal with 20,000 passengers an hour.

Manchester.—NEW TIME-KEEPING DEVICE.—The Corporation has adopted a new time-keeping device, operated from the car platform, wihch will obviate delay caused by conductors leaving the cars and waiting for the correct time before "clocking" at roadside time boxes. The new device has been introduced in order to lessen the number of accidents to conductors when leaving their cars to "clock on."

Wharfedale.—RAILWAY ELECTRIFICATION.—The proposal of the clerk of the Ilkley Urban District Council for the electrification of the railways from Leeds and Bradford into Wharfedale has received the support of the Guiseley Urban District Council, the Menston and Poole Parish Councils, and the Wharfedale Rural District Council, who are to petition the L.M. & S. Railway and L.N.E. Railway Companies to carry out the electrification of the lines.

Telegraph and Telephone Notes.

Austria.—LONG-DISTANCE TELEPHONY.—The first trunk cable between Vienna and Passau, on the German frontier, has been completed, and was to be opened to the public on January 4th, says *The Times*. The authorities will now immediately proceed to lay cables successively to the Italian, Jugo-Slav, and Hungarian frontiers. The cost, which has been estimated at £2,100,000, is being met out of the international loan granted to Austria under the guarantee of the League of Nations.

Central America.—RADIO-TELEGRAPHY.—The radio stations presented by the Government of Mexico to Guatemala and El Salvador have been completed and put into public service. They deal with ordinary messages, night and special Press service, and day and night letters. The neighbouring States of Honduras and Costa Rica have been brought into radio communication range.—*Reuter's Trade Service* (Guatemala City).

Spain.—AUTOMATIC TELEPHONY.—We are informed by Standard Telephones & Cables, Ltd., London, that King Alfonso, together with leading citizens, participated in the establishment of a new European long-distance telephone record on December 29th, when a conversation was carried on over a circuit of 3,800 kilometres long, as a feature of the inauguration of "Standard" rotary automatic telephone service throughout Madrid. The record was established in a demonstration of the lines of the nation-wide system that has been built in the last eighteen months by the Compania Telefonica Nacional de España and, although the distance covered was equal to that from Madrid to Moscow, the circuit did not extend beyond Spanish territory. It did, however, cross the Straits of Gibraltar by submarine cable, uniting the continents of Europe and Africa; sixteen stations responded to the roll-call over the circuit, which event was preliminary to the formal opening by King Alfonso of the new Madrid local telephone system, completely installed in fourteen months by the Compania Nacional. The change in service was accomplished simultaneously throughout the capital, and Madrid is second in the series of nineteen cities in which the company will convert the telephone service to rotary automatic within the coming three years.

Sweden.—TELEPHONE DEVELOPMENTS.—The Director-General of the Swedish Telegraph Board stated in a recent interview that a third telephone cable between Sweden and Germany would be laid this year, 1927, not only to meet the steadily increasing communication between Sweden and Germany, but also for an extension of telephone traffic to England, in which very great interest is shown, and perhaps later on to France and Italy. The planned telephone cable to Finland will not be laid yet, no allowance having been made in the Finnish Budget for this purpose. Among other features will be the continued erection of automatic telephone stations at Stockholm, the extension of the telephone cable northwards to Upsala and Gaefle, and an increased use of the Stockholm-Gothenburg cable.—*Reuter's Trade Service* (Stockholm).

INVENTIONS.—Two Karlskrona inventors, Consul K. Vogel and engineer J. G. Larsson, have succeeded in constructing apparatus which may be coupled to the telephone and registers communications to the subscriber during his absence. The inventors emphasise the fact that their apparatus is not a variation of existing "parlograph" systems.—*Reuter's Trade Service* (Stockholm).

The Telephone Service.—NEW EXCHANGE.—A new public telephone exchange for Camberley is to be opened on January 11th. The switchboard, which is located in a new building in Park Street, was made and installed by Siemens Bros. & Co., Ltd., and is of the latest pattern common-battery type with accommodation for 780 subscribers, which can be increased to over 1,000 as required. The new exchange will provide Camberley subscribers with automatic "calling" and "ring-off" signals in place of the existing old style "turn-the-handle" system, which is rapidly being superseded throughout the country.

Radio Notes.

Argentina.—NEW RADIO STATION.—A contract has been concluded for an additional radio-broadcasting station in the Colon Opera House, Buenos Aires, at an estimated expenditure of 100,000 dollars (£20,000). The station, which is to be built by a United States company, is to be in operation by May, 1927, in time for the next opera season.—*Reuter's Trade Service* (Buenos Aires).

Loud-Speakers Banned.—EASTBOURNE.—Another by-law affecting the use of broadcasting loud-speakers has come into force in England. The Eastbourne Watch Committee has been informed by the Home Office that such a by-law will be sanctioned, says the *Morning Post*, in the following form:

"No person shall in any street or public place, or in any place which adjoins any street or public place, and to which the public are admitted, operate, or cause or suffer to be operated, any wireless loud-speaker or gramophone in such a manner as to cause annoyance to, or disturbance of, residents or passengers. Any person offending against the foregoing by-law shall be liable to a penalty not exceeding £5."

Reading has already a by-law of this kind, and other towns are likely to follow suit if users do not exercise a little more discretion. In the main these by-laws affect the proprietors of wireless shops who make a practice of fixing a loud-speaker outside their premises with the object of attracting purchasers.

FRANCE.—The new year commenced with the issue of a police order for the suppression of loud-speakers used for advertising and other purposes in the streets of Paris. They have long been threatened by the police.

France.—STATE CONTROL.—Wireless-telephony in France is to be placed on a legal basis, according to a proposal made by the Minister of Commerce which has been unanimously approved by the Cabinet. Broadcasting becomes the prerogative of the State, which will assume possession of all transmitting stations in five years' time. Meanwhile broadcasting will be State-controlled by a mixed committee of Government officials, authors, musicians, and lecturers, who will supervise operation, which will be carried out by authorised private enterprise. During the transition period the State will receive a percentage of the advertisement receipts.—*Reuter* (Paris).

High-power Stations.—REGIONAL PLAN.—It is reported that the scheme for the erection of new regional higher-power broadcast stations for Great Britain and for the provision of alternative programmes has been agreed to by the Postmaster-General in its broad outline. The main idea is for a certain number of high-power stations to be erected, some in parts of the country at present without a station, says the *Daily Mail;* they will number five or six, and will have a power of 10-15 kilowatts, and there will also be other stations with the same power as that of London. It is expected that part of the scheme will be ready for inauguration at the end of this year.

India.—STATION SITE.—The Indian Radio Telegraph Co., Ltd., has accepted the terms offered by the Improvement Trust for the lease of land in the Cossipore-Chitpore open space for the location of a broadcasting station.

Japan.—NEW STATION.—An order is said to have been placed for a 600-kW station, which will be ready in 1928. It is to be entirely the property of the Japanese Wireless Telegraph Co., an official concern enjoying the support of Parliament.

Licences.—BIRMINGHAM'S RECORD.—A campaign against "pirates" is being conducted by Post Office officials in the Birmingham district, and it was explained during the hearing of summonses that the possession of apparatus which was not assembled, or the erection of an aerial only, did not relieve the owner of the obligation to take out a licence. The number of licences now issued in the city is approximately 100,000, and the proportion of licence-holders to the population is probably higher in Birmingham than in any other centre.

Sweden.—INTERFERENCE ELIMINATOR.—An invention to prevent interference between broadcasting stations issuing the same programme on the same wave-length has been made by the broadcasting expert of the Swedish Telegraph Office (engineer, S. Lemoine).—*Reuter's Trade Service* (Stockholm).

United States.—CONTROL URGED.—In a recent address, according to *World Radio*, Major-General J. G. Harbord, president of the Radio Corporation of America, said that under the present developments there were only 89 wave-lengths available within the United States, or approximately one-tenth the number of stations now in operation or projected in the immediate future. The National Radio Co-ordinating Committee had urged Congress to deal with the radio problem, saying that further delay would jeopardise a national industry involving $600,000,000 a year and disappoint 20,000,000 persons. The Co-ordinating Committee urged emergency legislation, necessary because broadcasting stations were increasing at the rate of one a day. The Committee urged prompt passage of a permanent control law, and endorsed the principle of the White Bill for control by a Federal Radio Commission and the United States Department of Commerce.

"ATMOSPHERICS."—In addressing a gathering of 1,500 scientists from all parts of the world at Philadelphia, Dr. Michael Pupin made the startling announcement that "atmospherics" and the fading nuisances so well known to wireless enthusiasts were "messages" from the sun and the planets. According to the *Daily Telegraph*, Dr. Pupin made it quite clear that he used the word "message" in a symbolic sense, and meant merely the electrical attraction between the earth and the planets as demonstrated by the periodical swing of great earth currents, the tidal flux of electricity through submarine cables, and objectionable noises in wireless instruments. These phenomena would in time be interpreted.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Ampthill.—January 12th. U.D.C. Electric light installation, public lavatories, depôt stores, and fire station; Mr. F. W. Walker, surveyor, 105, Dunstable Street.

Army Contracts.—Manufacturers who are not already on any War Office list of tenderers, and who wish to tender for Army requirements of cables, electrical stores, scientific instruments, &c., should apply to the Director of Army Contracts, Caxton House (West), Tothill Street, Westminster, S.W., for Form I, on which formal application for inclusion on the list of tenderers may be made. (See this issue.)

Australia.—MELBOURNE.—February 28th. City Council. Two 2,500-kW motor-convertors and accessories, or two 2,500-kW rotary convertors, with transformers and accessories. (B.X. 3124.)*

Argentina.—BUENOS AIRES.—February 24th. Department of Navigation and Ports. Three 10-ton electric shunting locomotives (Diesel type). (A.X. 4016.)*

Askern (near Doncaster).—January 18th. Electric light installation at Sutton Road new school. Education Department, West Riding County Hall, Wakefield.

Barking Town.—Electricity Committee. 1,000-kW motor-convertor.

Barnes.—February 8th. Electricity Department. One 1,000-kW rotary or motor convertor with transformer, l.p. switchgear and connections. (See this issue.)

Belgium.—Municipal authorities of Schaerbeek. 11,500 metres of h.p. and l.p. armoured cable and 1,500 electricity meters.

Bootle.—January 18th. Corporation. Electrician's work required in erection of 16 lock-up shops, with 16 flats above, Bailey Drive. Particulars from Borough Engineer, Town Hall.

Bradford.—January 11th. Corporation. Electric lighting installations at housing schemes, No. 3, Bradford Moor (12 combined shops and houses); No. 9, Bierley (16 combined shops and houses); and No. 11, Swain House (594 houses). City Architect, Town Hall, Bradford.

Burnley.—January 27th. Tramways and Omnibus Department. General stores for 12 months. Schedules from the General Manager, Queensgate Depôt, Burnley.

Canada.—GREAT FALLS.—January 17th. Manitoba Power Co., Ltd. Three 7,000-kVA single-phase oil-insulated indoor-type transformers for Lac du Bonnet, Manitoba. (B.X. 3118.)*

Doneraile (Co. Cork). — Cork County Sanatorium. Supply of electrical fittings and installation of electric bells, &c., at the Sanatorium. Mr. C. J. Murphy, secretary to the Committee of Management, Courthouse, Cork.

Ecuador.—QUITO.—Municipal Council. 3,000-h.p. hydro-electric plant for which water power with a fall of 42 metres is available, to be owned and worked by the city authorities. A second installation of similar capacity, for the port and city of Guayaquil, is also contemplated.

Falcarragh (Co. Donegal).—Installation of an electric lighting plant. Mr. A. J. O'Doherty, secretary, Falcarragh.

Haverfordwest.—January 15th. Water Department. One vertical treble plunger pump (16,000 galls. per hour capacity) and one 50-b.h.p. (approx.) semi-Diesel oil engine. Particulars from the Water Engineer.

India.—India Store Department. January 25th. Overhead electric travelling cranes (two 60 tons, four 25 tons, two 120 tons, three 8 tons, one 5 tons). Specifications (5s.) from 15, Belvedere Road, Lambeth, S.E.

Liverpool.—January 19th. Electricity Supply Department. 250,000 tons best quality steam slack during the 12 months to March 31st, 1928. City Electrical Engineer.

January 27th. Electricity Supply Department. Twelve months' supply materials, including cables and accessories, insulated cables, meters, lamps, &c. (See this issue.)

London.—LONDON COUNTY COUNCIL.—January 10th. Electrical installation at the Frankham Street, Deptford, S.E., elementary school (approx. 153 points). (December 31st.)

STEPNEY.—January 18th. Board of Guardians. Electric goods lift at the St. George's-in-the-East Hospital. (December 31st.)

Manchester. — January 11th. Tramways Committee. Electrolytic and cadmium copper trolley wire. Particulars from the General Manager and Chief Engineer.

Newport (Mon.).—February 5th. Electricity Department. Two water-tube boilers, steam and feed-water piping, economisers, air heaters, induced- and forced-draught plant, steel stack and grit catcher, coal and ash conveyors, extension of boiler house, including structural steelwork and foundations. (See this issue.)

New Zealand.—DUNEDIN.—February 19th. City Corporation Gas Department. One motor-generator with control board and accessories. (B.X. 3095.)*

Romford.—January 10th. Board of Guardians. Intercommunicating telephone installation. (December 31st.)

Salford.—January 8th. City Council. Electrical wiring of premises, 143 and 147, Regent Street. Specifications from Medical Officer of Health, 143, Regent Road.

South Africa. — PRETORIA. — February 3rd. Municipal Council. E.h.p. cable and accessories, switches and cut-outs. (B.X. 3097.)*

JOHANNESBURG.—January 20th. Municipal Council. Supply of electric lamps. (B.X. 3112.)*

Stoke-on-Trent.—February 8th. Stoke and Wolstanton Union. Alterations and additions to the central-heating and hot-water services at the London Road Institution. The work includes large calorifiers, two electric generating sets, pumps, &c. Specification from Mr. T. Wood, clerk to the Guardians, Union Offices, Stoke-on-Trent.

February 9th. Electricity Department. Steam and water piping, valves, &c., constructional steel work, platforms, crane gantries, &c. (See this issue.)

Torquay.—Electricity Department. Railway siding and coal-handling scheme for Newton Abbot power station. Construction of elevated railway siding upon reinforced concrete gantry; one rotary wagon tipper; one railway wagon weighbridge with weighhouse; electric capstan and fair leads; coal-conveying plant; one 1,000-ton concrete storage bunker. Forms of tender, Mr. H. F. G. Woods, Electricity Offices, Upton Valley, Torquay.

Uruguay.—MONTEVIDEO.—February 18th. State Electricity Works. 65,000 kg. unvarnished black iron wire and 10,000 kg. g.i. wire. (A.X. 4019.)*

February 11th. 37,500 electric filament lamps. (B.X. 3117.)*

February 15th. 55,500 iron pieces (angles, ties, bolts, &c.) for overhead lines. (A.X. 4018.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birmingham.—Electric Supply Department. Particulars are given in our "Business Notes" of an important contract (£1,435,850) awarded to International Combustion, Ltd., for a new power station.

Brentwood.—Essex Education Committee. Accepted:—
Installing electric lighting at the County High School for Girls (£675).—A. Goodwin & Co.

Erith.—Urban Council. Accepted:—
Stock cable (£418).—Callender's Cable & Construction Co., Ltd.

Hebden Bridge.—
Electrical wiring, &c., at Council houses.—J. Harrison and Co., Halifax.

London.—BOOTH STEAMSHIP CO.
12 months' supply of electric lamps.—Siemens & English Electric Lamp Co., Ltd.

ADMIRALTY.
Accumulators.—Edison Swan Electric Co., Ltd.

LONDON & NORTH-EASTERN RAILWAY CO.
Railway-carriage lighting.—Edison Swan Electric Co., Ltd.

Salford.—Health Committee. Accepted:—
Wireless receiving apparatus for the Ladywell Sanatorium (£138).—Marconiphone Co., Ltd.

Education Committee. Accepted:—
Alterations to the electric lighting installation at the Royal Technical College.—County Electrical Co., Ltd.
Installing electric lighting at the Trafford Road Council School (£125).—Taylor & Son.

Tramways Committee.
Sand-drying plant (£500 approx.).—Pneulec Co., Ltd.
Two Morris travelling electric hoist blocks (£207).—Herbert Morris, Ltd.

Electricity Committee.
9,000 yd. l.p. and 450 yd. e.h.p. cable (£2,740).—H. V. Nederlandsche Kabelfabriek, Delft, Holland.

Southend-on-Sea.—Town Council. Accepted:—
Five top covers for tramcars (£1,625).—Brush Electrical Engineering Co.
3-ton electric crane (£1,190).—Smith & Co.

Windermere.—Urban Council. Accepted:—
Laying cables for the Oldfield housing scheme (£325).—Windermere and District Electricity Supply Co., Ltd.
Supplying and installing wires (£168).—J. K. Thornborough & Co.

Worcester.—Infirmary Committee. Accepted:—
Installing a telephone system in the infirmary.—British Telephone Supply Co.

York.—Works Committee. Recommended:—
Electric wiring at Foss Islands depôt (£80).—H. Hetherington.

Forthcoming Events.

Edinburgh Electrical Society.—Friday, January 7th. Royal Scottish Society of Art, 117, George Street. 8 p.m. Social and dance.

Junior Institution of Engineers.—Friday, January 7th. 39, Victoria Street, S.W. 7.30 p.m. "Distortion in Heat-treated Case-hardened Carbon Steels." Mr. P. J. Haler.
Friday, January 14th. 7.30 p.m. "The Thermionic Valve and its Characteristics." Mr. R. L. Kirlew.

Institution of Fuel Economy Engineers.—Friday, January 7th. Royal Society of Arts, Adelphi, W.C. 6 p.m. "Utilisation of Low-grade Fuels for Steam Generation." Mr. W. F. Goodrich.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, January 8th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Collieries and Public Supply." Mr. T. S. Thomas.

(Western Sub-Branch).—Saturday, January 8th. 60, Wind Street, Swansea. Informal discussion on "Chief Electrical Inspector's Report, 1925-1926." Mr. J. A. B. Horsley, Electrical Inspector of Mines, will reply to the discussion.

Institution of Electrical Engineers.—INFORMAL MEETING.—Monday, January 10th. London. 7 p.m. "Some Notes on the Earthing of Metal Objects other than Conductors, and General Remarks on the Earthing of Electrical Circuits." Mr. S. W. Melsom.

(Mersey and North Wales (Liverpool) Centre).—Monday, January 10th. Liverpool University. 7.30 p.m. Faraday Lecture, "What is Electricity?" Prof. W. M. Thornton.

(North-Eastern Centre).—Monday, January 10th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Ordinary meeting.

(North-Midland Centre).—Tuesday, January 11th. Hotel Metropole, Leeds. 7 p.m. "The Design of City Distribution Systems." Messrs. J. R. Beard and T. G. N. Haldane.

(North-Western Centre).—Tuesday, January 11th. Engineers' Club, Manchester. 7 p.m. Ordinary meeting.

(Western Centre).—Monday, January 10th. Royal Hotel, Bristol. 5.30 p.m. Reception 6 p.m. Annual dinner and visit of the President.

(Scottish Centre).—Tuesday, January 11th. North British Station Hotel, Edinburgh. 7 p.m. "The Applications of Electricity to Agriculture." Mr. R. B. Matthews.

(Dundee Sub-Centre).—Thursday, January 13th. University College. 7.30 p.m. "Government Scheme of the Electricity (Supply) Bill." Mr. D. H. Bishop.

(South-Midland Centre).—Friday, January 7th. Engineering and Scientific Club, Queen Street, Wolverhampton. 7 p.m. "Electrical Research." Mr. W. Wilson.

Nottingham Society of Engineers.—Monday, January 10th. "Electricity in the Home." Mr. G. S. Haydon.

Electrical Power Engineers' Association (Glasgow Section). Tuesday, January 11th. Reid's Restaurant, Gordon Street, Glasgow. 7.30 p.m. "Boiler Rings." Mr. J. A. Cogan.

(Manchester Section).—Thursday, January 13th. Geographical Hall, Manchester. 7 p.m. "Metering of Three-phase Supplies." Mr. O. Howarth.

Institute of Marine Engineers.—Tuesday, January 11th. The Minories. 6.30 p.m. "Progress in the Development and Practical Application of Heat-resisting and Non-corroding Steel." Sir R. A. Hadfield, Bart., F.R.S.

Röntgen Society.—Tuesday, January 11th. 32, Welbeck Street, W. 8.15 p.m., Ordinary scientific meeting.

Illuminating Engineering Society.—Tuesday, January 11th. Lighting Service Bureau, 15, Savoy Street, W.C. 6.30 p.m. "Flood Lighting." Messrs. W. J. Jones, H. Lingard, and T. Catten.

Electrical Society of Glasgow.—Tuesday, January 11th. 30, Gordon Street, Glasgow. 7.30 p.m. "A Survey of the Conditions of Trading in the Electrical Industry." Mr. A. Ramsay.

Institution of Civil Engineers.—Tuesday, January 11th. London. 6 p.m. "The Economics of Power Production and Utilisation at Collieries." Prof. D. Hay.

Royal Society of Arts.—Wednesday, January 12th. John Street, Adelphi, W.C. 3 p.m. "The Story of a Wireless Valve." (Juvenile Lecture.) Prof. C. R. Darling.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, January 14th. Literary and Philosophical Society, Newcastle-upon-Tyne. 6 p.m. "Progress in Economy of Turbine Machinery on Land and Sea." Sir Chas. A. Parsons and Mr. R. J. Walker.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

VENTEX candle lamps.

Notes.

Wattmeter Calculations.

With reference to the article under the above title which appeared on p. 1064 of our issue of December 31st, it should be stated that the work described therein was carried out in the Research Department of Burndept Wireless, Ltd., and was published with their permission.

Royal Scholarships and Free Studentships.

The Board of Education has awarded Royal Scholarships to, amongst others, E. E. Wilkins and G. W. Dimmick, electrical fitter apprentices, and J. L. Howard, electrical engineer apprentice, and a Free Studentship to W. T. Pratt, electrical fitter apprentice—all at H.M. Dockyard.

Lectures.

THE POLYTECHNIC.—A course of four lectures, entitled "Sidelights on Broadcasting," is to be given by Capt. Jack Frost, M.I.R.E. (late of the B.B.C.), on Friday evenings, commencing on January 21st, at the Regent Street Polytechnic, London. The lectures will be popular in character, fully illustrated with lantern slides, and include demonstrations. The fee for the course is 5s.

LONDON COUNTY COUNCIL.—HACKNEY INSTITUTE, E.—A course of lectures on Electrical Power Control and Measurement will be given in the Institute on Wednesday evenings, commencing January 12th. Full particulars of the course may be had on application to the principal.

Appointments Vacant.

Temporary shift charge engineer for the Leigh Corporation Electricity Department. Electrical engineer (£350) for the Borough of Newark Electricity Department. Two charge engineers (400 taels per month) for the Shanghai Municipal Electricity Department. (See our advertisement pages to-day.)

Swiss Railway Electrification Economies.

In an article upon the Swiss Federal Railways, *Commerce Reports* states that considerable economy has been effected by electrification. A table is included which shows the actual costs of operating the electrified system in 1924, and compares the costs of steam working; this is reproduced below:

Operating item.	Electric. fr.	Steam. fr.
Cost of driving *personnel*	4,587,000	6,553,000
Cost of *personnel* at depôts ...	705,000	1,210,000
Surplus expenses for *personnel* on trains and for cleaning the cars, with steam traction	—	870,000
Cost of upkeep of locomotives and motor-coaches	3,082,000	4,150,000
Cost of greasing material	101,000	132,000
Surplus cost for upkeep of cars and wagons, with steam traction ...	—	50,000
Total	8,475,000	12,965,000

It is seen that the savings from these items alone reach nearly 4,500,000 Swiss francs, or approximately 35 per cent. of the cost under steam traction. Thus, with the electrification programme completed in 1929, the economy effected by the reduced cost for these items and for coal will ensure a very appreciable cut in the Swiss budget.

Fourth Conference on Large Extra-High-Pressure Systems.

This conference will be held in Paris from June 23rd to July 2nd, 1927. The Council of the Institution of Electrical Engineers will shortly nominate those who will attend the conference as the official delegates of the Institution, but, in addition, any members of the Institution can attend the conference as unofficial delegates. The latter should send their names, together with a remittance of £2, to the Secretary of the Institution, who will obtain the necessary membership cards.

University of London.

In connection with the celebration of the centenary of the University College, University of London, an appeal is being made for £500,000, one half of which is required to provide increased endowment for improving the salaries of the staff, and the other half is wanted for extensions and reconstructions to the present buildings, including a new block for chemical engineering. Sir Gregory Foster, Provost of University College, recently outlined the future programme of the University and its history to representatives of the Press. In 1831, when the first calendar of University College was issued, it had two faculties—Arts and Laws, and Medicine. The total staff numbered 30 and the number of departments 33. In 1926 there were five faculties—Arts, Laws, Science, Engineering, and Medical Science. There were 75 departments and 254 members on the academic staff. To-day the students of the college number 3,200, as compared with 420 in 1831. Engineering was introduced into the University in 1835, when a lectureship in civil engineering was established. Later, the chairs of civil, mechanical, electrical, and municipal engineering were established in the order given. One of the features of the progress made in University College is the co-operation which now exists between the departments, particularly between the engineering and science departments.

Accident.

Two men were severely burned by molten lead on December 30th as the result of an explosion at the Belvedere works of Callender's Cable & Construction Co., Ltd.

Wireless Telegraphy Commission.

This Commission was appointed in 1920 to decide upon the plant most suitable for carrying out the scheme of Imperial communication recommended by the Imperial Wireless Telegraphy Committee. A first report was submitted to the Cabinet on December 5th, 1921, and the second report (Cmd. 2781; Stationery Office, price 2d.) describes the proceedings of the Commission afterwards, the decision of the Cabinet in 1923 to go on with the construction of a powerful station in England, and the arrangement come to in 1924 between the Postmaster-General and Marconi's Co. for the construction of "beam" stations for telegraphy between England and Canada, with possible extensions giving similar communication with Australia, South Africa, and India. In each of these countries, the report says, the work on corresponding stations is well advanced. With regard to the Rugby station, the site was chosen to accommodate 16 masts, each 820 ft. high, but for economy it was decided to erect only 12 masts in the first instance. The power plant installed is capable of converting about 1,800 kW into suitable form for use in the wireless plant. The high-frequency generator consists of two exciting units in duplicate and a main amplifier of five similar panels, each containing eighteen valves and capable of giving a high-frequency output of 180 kilowatts at a frequency of 16,000 cycles per second. By using three panels a total output capacity of about 500 kilowatts is available for use on the whole aerial, leaving two panels in reserve. Alternatively, the two sections of the aerial, each working with two power panels, can deal with about 300 kilowatts and 200 kilowatts respectively, leaving one power panel in reserve. Up to the date of the report (July 7th, 1926) the smaller section of the aerial had been reserved for use with an experimental telephony transmitter, and good and reliable two-way conversation across the Atlantic to New York had been obtained repeatedly for many hours of the day.

The telegraphy installation had only been worked on the eight-mast aerial with about two-thirds power; even so, the signals had been heard all over the globe. A summary of the reports on the signals received at different distant places is appended to the report. The lay-out was designed to provide for the simultaneous use of two transmitters during the most favourable atmospheric periods. Experiments on the main telegraph transmitter and the transatlantic telephony transmitter will determine whether simultaneous operation is feasible. In addition, further installations are in contemplation, namely, short-wave and medium-wave plant, utilising the existing masts for supporting the additional aerials.

(The complete aerials, supported on 12 masts, have since been employed; the use of the north and south aerials combined in parallel has resulted in the normal working current being increased from 550 to 740 amperes. The present limiting condition with regard to the power output is the voltage on the aerial system, the normal working value of which is 156,000 V. With masts earthed, an aerial current of 810 A has been obtained.—EDS. ELEC. REV.)

B.E.S.A. Publication.

The British Engineering Standards Association has just issued a specification for flameproof enclosures for electrical apparatus and machinery (for use in mines and other places where an explosive atmosphere may be encountered) and of tests for such enclosures. The specification defines the tests which the flameproof enclosure must withstand, and the definition has received acceptance in several parts of the world. The test clauses have been associated with conditions which aim at securing that the certificates of compliance with the flameproof test should be issued only when the apparatus conforms to British Standard Specifications, where these exist, and the request has been made that more complete specifications for control gear than those now existing should be prepared. In this connection it is of interest to note that committees acting conjointly under the Electrical and Colliery Sections of the B.E.S.A. are preparing specifications for mining motors, switchgear and controllers for use in mines which make use of the tests given in this publication in order to ensure the flameproof properties of the gear. Copies of this new specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

Fatality.

Thomas Hester, a ganger, recently employed on the construction of the new Albert Bridge over the Thames between Old Windsor and Datchet, pierced a temporary cable used in the construction of the bridge, and received a fatal electric shock. At the inquest, on December 29th, it was stated that rats and birds had scraped the earth away from the adjoining bank and covered the cable, which was usually laid above the ground.

Electric Telpherage.

In a publication under the above title, by G. W. Grossmith, M.C., issued by the Technical Section of the Association of Engineering and Shipbuilding Draughtsmen, the general design of electric telpher systems is considered, and typical selected examples are dealt with in detail. The advantages claimed for the telpher over other conveyor systems are, generally, that it has a comparatively small proportion of working parts, with consequent low maintenance costs, and that it is only in motion when there is useful work to be done. Calculations are given for obtaining the h.p. of the travelling motor, and the angle of bogie swivel, in addition to the necessary constructional dimensions for the various types of plant. The importance of obtaining correct balance for the bogies is stressed and the limits of accuracy for the different systems are defined. The top-rail and bottom-flange systems are briefly described and compared, and the designs for a 60-ft. span lattice girder and ordinary and open trestles are dealt with in detail. An interesting feature of the book is a description of the all-wheel-drive coal-handling plant installed at the Nechells power station of the Birmingham Corporation Electricity Department. Copies of the publication may be obtained from the Association Secretary, 96, St. George's Square, London, S.W.1, price 2s. each.

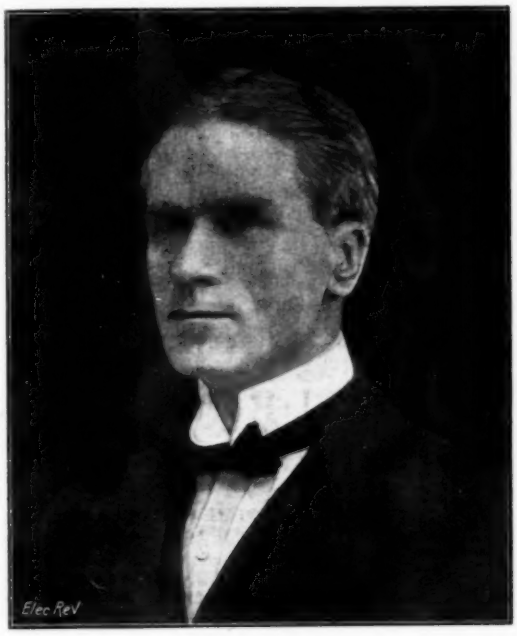
Incorporated Municipal Electrical Association.

ANNUAL CONVENTION.—The preliminary programme for the annual convention of the I.M.E.A. has now been issued. It will be held at Buxton, from May 30th to June 4th; on Tuesday, May 31st, the convention will be opened by the Mayor of Buxton, and Mr. R. W. L. Phillips, M.I.E.E., engineer and manager of the Bedford Corporation Electricity Department, will read his presidential address, which will be followed by a paper and discussion. In the afternoon the exhibition of electrical apparatus will be visited, the Mayor will entertain the visitors at tea in the Pavilion, Buxton Gardens, and in the evening the president will hold a reception. Papers and business meetings will occupy the following mornings, and visits to places of interest will be arranged for the afternoons, as usual. The annual dinner will take place on Thursday evening, June 2nd. Communications should be sent to the Secretary, Electric House, 38, High Street, Croydon.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

New Year Honours.—We offer our congratulations to two gentlemen well-known in the electrical world upon their inclusion in the List of New Year Honours. Mr. Duncan Watson, M.I.E.E., whose connection with the electrical contracting and manufacturing trades began very many years ago, and continues to-day as Duncan Watson & Co., and whose services rendered to Marylebone as chairman of the Borough Council Electricity Committee and subsequently as Mayor, stand out prominently in his career, has since late in 1925 been filling the important office of first chairman of the London and Home Counties Joint Electricity Authority. May Sir Duncan Watson live long to enjoy the honour of knighthood now conferred upon him. Mr. John Charles Walsham Reith, upon whom His Majesty also confers the honour of knighthood, is well known as managing director of the British Broadcasting Company, whose success during the pioneering years of the greatest and most rapidly developing undertaking ever known is fully recognised by electrical men.



Hana.] [*London.*

Sir Duncan Watson, M.I.E.E.

At Bangor borough electricity works, last week, Mr. C. H. GOODWIN, assistant electrical engineer of the city, was presented with a gold watch, subscribed for by the electricity works staff. The presentation was made by Mr. John Jones, the oldest workman, who was himself subsequently presented with an armchair. Mr. Price White, the borough gas and electrical engineer, presided.

Mr. W. E. C. LAMPERT, who was recently appointed assistant electrical engineer at Devonport Dockyard, was married at Plymouth, on December 29th, to Miss Lilian Glanfield.

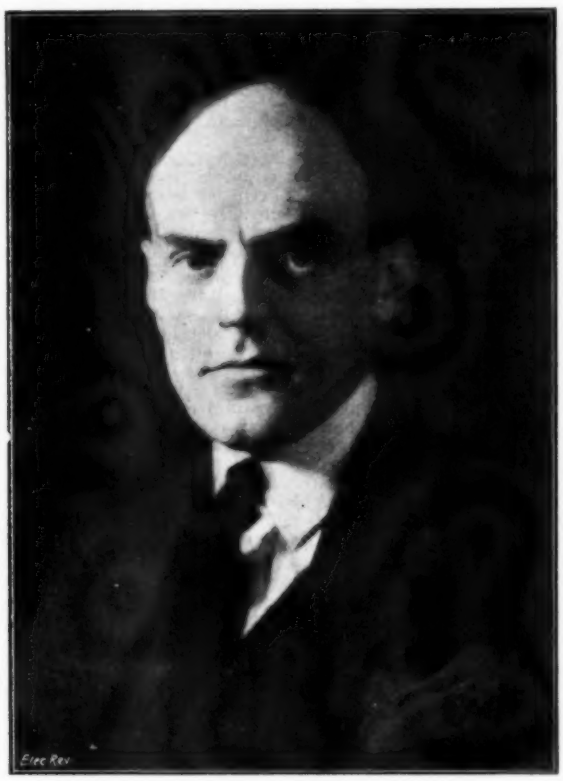
MR. STANLEY HODGKIN, joint managing director of the Pulsometer Engineering Co., Ltd., of Reading, on completing 50 years' association with the firm, has been presented by the senior members of the staff with a gold watch and a framed address. The presentation was made at a complimentary dinner at Mr. Hodgkin's residence, Old Southcote Lodge, Reading, when as guests of Mrs. Hodgkin a number of members of the staff were present. Mr. C. E. Hodgkin, who has been associated with his brother in the control of the business for 25 years, testified to his brother's qualities.

The Maidstone Town Council has appointed Mr. D. MACBEAN as constructional engineer and draughtsman for the electricity works extension.

Modern Transport states that Mr. J. DALRYMPLE has been asked to act as tramway adviser to the Johannesburg Municipality, and he has decided to proceed to South Africa when his investigations in South America are completed. As a farewell gift, the staff and employés of the Glasgow Corporation Tramway Department have presented Mr. Dalrymple with a cabinet and bookcase, and a dressing case for Mrs. Dalrymple.

We are informed that MR. WILLIAM WHITE has joined the Buenos Aires telephone organisation as chief installer, and not as chief engineer as stated in our issue of December 24th, p. 1045.

It is announced that Mr. E. R. PEACOCK has resigned his position as chairman of the Mexican Light and Power Co., Ltd., and the Mexico Tramways Co. on account of the pressure of other business; he will remain a director and continue to act as chairman of the Bondholders' Committee. He is succeeded by Mr. Millar Lash, K.C., legal adviser and vice-president of the companies. Mr. R. C. Brown has resigned the position of president of the two companies, remaining as vice-president, and is succeeded by Mr. G. R. G. Conway, managing director in Mexico, who will undertake the duties of both offices.



Sir John Reith.

Mr. WILFRED F. SANDS, of the Wolverhampton Corporation electricity staff, has been appointed assistant manager of the Electrical Distribution, Ltd., North Wales, and will be stationed at Llandudno Junction.

MR. D. ALAN STEVENSON, of the firm of D. & C. Stevenson, Edinburgh, has been appointed lighthouse engineer to the Government of India to advise on the reorganisation of the Indian lighthouse service, and to advise generally on the lighting of the coasts of India, Burma, and the Persian Gulf. Mr. Stevenson has sailed for India, and will be some months engaged there in advising the Government.

Mr. S. J. GODDARD, vice-president of the Western Union Telegraph Co.; Rear-Admiral C. P. R. COODE, C.B., D.S.O., general manager of the European Division; Mr. R. D. PAULIN, European traffic manager; and Mr. H. K. KINGSBURY, assistant general manager, went to Penzance to be guests of honour at the 33rd annual dinner and smoking concert of the local staff of the company on Saturday last. The dinner took place in the room in which the event was inaugurated on January 1st, 1888, and 31 diners sat down under the chairmanship of the superintendent of the Penzance station, Mr. T. O'Donoghue.

Science reports that Dr. W. D. COOLIDGE, assistant director of the research laboratory of the General Electric Company (America), has been awarded the Edison medal for 1926, by the American Institute of Electrical Engineers, "for the origination of ductile tungsten and the fundamental improvement of the X-ray tube."

Mr. W. VINCENT WAITE, M.I.Mech.E., A.M.I.E.E., has resigned his position of London manager to Messrs. Clayton Wagons, Ltd., and Messrs. Clayton & Shuttleworth, Ltd., and asks that communications be sent to his temporary address:—Room 75, Empire House, 175, Piccadilly, W.1.

Obituary.—M. GASTON SCIAMA.—The death occurred on November 24th last of M. Gaston Sciama, the general director of the Maison Breguet, of Paris, France. The deceased, who had been associated with the firm since 1884, was an ex-president of the Société Internationale des Electriciens.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

H. Lewis, Ltd.—Private company. Registered December 28th. Capital £2,000 in £1 shares (1,000 7½ per cent. cumulative preference and 1,000 ordinary). Objects: To acquire the business of an electrical and mechanical engineer, &c., now carried on by H. Lewis at Wisbech, Cambs., as "H. Lewis." The permanent directors are:—H. Lewis, 5, North Street, Old Market, Wisbech; Mrs. Margaret G. Lewis, 5, North Street, Old Market, Wisbech. Qualification, £100 shares. Solicitors: Ollard & Ollard, Wisbech.

Continental Hydro-Electric Co., Ltd.—Private company. Registered December 28th. Capital, £20,000 in £1 shares. Objects: To seek for, prospect and test means and facilities in all parts of the world for the generation, utilisation, manufacture, distribution and supply of light, heat, sound, power and energy by the utilisation of rivers, watersheds, seas and water supplies and any other natural or other resources, to dispatch and supply commissioners, investigators, experts and agents, to carry out any works deemed expedient, to carry on the business of suppliers of electricity, &c. The provisional directors are:—B. C. Pearson, 47, Parliament Street, S.W., director of public companies; C. S. Gulbenkian, 27, Quai d'Orsay, Paris, director of public companies. No qualification required. Solicitor: H. Davey, 47, Parliament Street, S.W.1.

J. R. Jennens, Ltd.—Private company. Registered December 28th. Capital £500 in £1 shares. Objects: To carry on the business of wireless apparatus manufacturers and dealers, &c. The first directors are:—J. R. Jennens, 51, Earlsbury Gardens, Handsworth, Birmingham; F. Stickley, 138, Winson Green Road, Birmingham; F. G. Layland, 42, Kentish Road, Handsworth; J. H. Jennens, 226, Boldmere Road, Wylde Green, Birmingham, manufacturer. Qualification, 50 shares. Solicitor: R. E. Parr, 83, Colmore Row. Registered office: 13, Jennens Row, Birmingham.

Elliott's Electrical Construction Co., Ltd.—Private company. Registered December 23rd. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrical contractor and engineer now carried on by A. J. Elliott at Coronation Buildings, High Street, Gateshead. The directors are:—A. J. Elliott, 113, Biddlestone Road, Heaton, Newcastle-on-Tyne; J. E. Stephenson, Highcliff, Windsor Crescent, Whitley Bay. Secretary: J. E. Stephenson. Registered office: Coronation Buildings, 136, High Street, Gateshead.

Solidite and Synthetic Mouldings, Ltd.—Private company. Registered December 24th. Capital, £20,000 in £1 shares. Objects:—To adopt an agreement with J. A. Swain and to carry on the business of manufacturers of and dealers in the preparations known as "Solidite," and all improvements therein, and all goods to which solidite may be applicable, manufacturers of and dealers in india-rubber, vulcanite, ebonite, fibres, tires, chemicals and drugs, glassblowers, &c. The subscribers (each with one share) are:—L. R. Shaw, 4, Broad Street Place, E.C., accountant; B. Reynolds, 22, Dalmeny Avenue, N.7, accountant. First directors:—Sir C. S. Forbes, Bart., 25, Holland Park, W.11; T. E. Slaughter and A. J. Swain. Qualification, £1. Solicitors: Hoale, Smith & Field, 4, Broad Street Place, E.C.2.

Reliance Trading Co. (Liverpool), Ltd.—Private company. Registered December 24th. Capital £100 in £1 shares. Objects: To carry on the business of electrical, mechanical, marine engineering, aeronautical and general agents, manufacturers of and dealers in electrical plant and appliances, and wireless plant and accessories, &c. The subscribers (each with one share) are:—S. A. Romain, 31, Brompton Avenue, Liverpool, manufacturers' agent; P. Bredsni, 26, Montague Street, Liverpool, meat salesman. The first directors are to be appointed by the subscribers. Qualification, 25 fully-paid shares. Remuneration as fixed by the company. Secretary: S. R. Ashcroft, 36, Kirkdale Vale, Liverpool.

Husbands, Hart & Warburton, Ltd.—Private company. Registered January 3rd. Capital, £3,000 in £1 shares. Objects:—To acquire the business of electrical engineers or otherwise, carried on as "Husbands, Hart & Warburton," at City Road Mills, Derby, and elsewhere. The permanent directors are:—J. Husbands, 15, Chestnut Avenue; H. H. Hart, The Cottage, Alfreton Road; G. F. Warburton, Belper Road, all of Derby. Qualification, 25 shares. Solicitor: W. H. M. Marsden, 42, Full Street, Derby.

Foster-Boynton & Co., Ltd.—Private company. Registered January 1st. Capital, £300 in £1 shares. Objects:—To carry on the business of manufacturers of, or dealers in radio, cycles, and component parts thereof, &c. The directors are:—D. W. Foster, 1108, Stratford Road, Hall Green, Birmingham; H. Boynton, 4, Woodstock Road, Moseley, Birmingham. Qualification, 1 share. Registered office: 70, Lombard Street, Birmingham.

Maitland & Co. (Manchester), Ltd.—Private company. Registered January 3rd. Capital, £3,000 in £1 shares. Objects:—To acquire the business of an electrician, electrical engineer and contractor carried on by J. W. Maitland at 29, Princess Street, Manchester, as "Maitland & Co.," and to carry on the same and the business of armature winders, manufacturers of, and dealers in radio and other apparatus, &c. The subscribers (each with one share) are:—J. W. Maitland, 29, Princess Street, Manchester, electrical engineer; A. W. Maitland, Silver Street, Bury, solicitor. J. W. Maitland is permanent governing director, subject to holding a third of the issued capital, with power to appoint other directors. Qualification, after termination of original management, £100. Remuneration, after termination of original management, as fixed by the company. Solicitor: P. S. Howarth, Silver Street, Bury.

Official Returns of Electrical Companies.

Bastian Electric Co., Ltd.—H. G. Ash, of Finsbury Court, Finsbury Pavement, E.C.2, ceased to act as receiver or manager on December 15th, 1926.

Goswell Engineering Co., Ltd.—Debenture dated December 13th, 1926, to secure £300, charged on the company's undertaking and property, present and future. Holder: A. P. Barry, The Old Court House, Limpsfield.

General Radio Co., Ltd.—Satisfaction in full on November 18th, 1926, of debentures, second series dated June 2nd, 1925, securing £1,500.

J. H. Nott & Sons, Ltd.—Mortgage on Wessex Works, Frome, with machinery, &c., dated December 14th, 1926, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Townson & Chadwick, Ltd.—E. Price, of Daisey Hill, Adlington, late of Cross Street, Manchester, ceased to act as receiver on November 26th, 1926.

Finston Manufacturing Co., Ltd.—Issue on November 23rd, 1926, of £500 debentures, part of a series already registered.

V. Badman, Ltd.—Debenture dated November 30th, 1926, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: V. Badman, 88, Western Road, Southall.

Ebonite Container Co., Ltd.—Satisfaction in full on November 10th, 1926, of charge dated January 20th, 1925, securing £1,500.

Grierson, Ltd.—Capital, £10,000 in 6,000 ordinary and 4,000 preference shares of £1 each. Return dated November 30th, 1926. 2,501 ordinary shares taken up. £2,501 paid. Mortgages and charges, nil.

Frinton-on-Sea and District Electric Light and Power Co., Ltd.—Capital, £10,000 in 7,300 preference and 2,700 ordinary shares of £1 each. Return dated November 16th, 1926. All shares taken up. £10,000 paid. Mortgages and charges, £4,000.

Kalgoorlie Electric Power and Lighting Corporation, Ltd. —Capital, £50,005 in 5 preference shares of £1 each and 100,000 ordinary shares of 10s. each. Return dated July 16th, 1926. 100,000 ordinary shares taken up. £3 10s. paid. £49,996 10s. considered as paid. Mortgages and charges, £111,235.

Electro-Mechanical Brake Co., Ltd.—Capital, £30,000 in 2,500 preference and 27,500 ordinary shares of £1 each. Return dated November 29th, 1926. 1,500 preference and 26,500 ordinary shares taken up. £21,965 paid on 1,500 preference and 20,645 ordinary shares. £6,035 considered as paid on 6,035 ordinary shares. Mortgages and charges, £7,500.

City Notes.

Edison Swan Electric Co., Ltd.

The annual meeting was held on December 29th. Mr. W. Shearer (chairman) presided, and in moving the adoption of the report (*vide* our last issue, p. 1086), said that as he and the majority of his colleagues had only been directors for some two or three months it would not be possible for him to present any elaborate or detailed review of the affairs of the company. They were fortunate in still having with them two of the old directors, Mr. C. H. Cox and Mr. E. A. Gimingham. Commenting on the balance sheet, he said that the item of patents, goodwill, &c., had been reduced during the year by £59,504, and the figure stood at £86,000 less than in 1923. Investments had increased during the year by reason of the shares which they had taken in the Edison Swan Cables, Ltd. They now held the whole of the ordinary shares in that company, and since they had become actively identified with the management of that concern considerable progress had been made. The output had been speeded up, the selling organisation had been improved, and they had taken over the principal selling agency. The works were now running at their full capacity, and considerable extensions were in contemplation. They looked upon that business as a sound acquisition, and one which had excellent prospects. Stocks, which included work in progress, amounted in the aggregate to £227,075. The reserve account was £50,000 more than at the corresponding date last year, and now stood at £130,000. The profits shown were not quite so favourable as those of the preceding year, which was an exceptionally good one. Having regard to the fact that the general strike occurred in the period covered by the accounts and that the last two months of the year's trading was affected by the coal dispute, he did not think the shareholders had any cause to be dissatisfied with the figures. As to the prospects for the current year, the labour disputes which continued for five months of the period had naturally had a detrimental effect upon the business, but he was pleased to tell them that since the termination of the coal trouble sales had increased very satisfactorily, and it was to be hoped that the improvement would be maintained notwithstanding the attenuated demand which would probably be experienced for some time. In conclusion, he paid a tribute to the work of the late board, who, he said, had had a very heavy task to perform during the last three years. In particular their thanks were due to the late chairman, Mr. C. F. Spencer. They had been endeavouring to induce him to rejoin the board and take up his old position again as chairman, and he (the chairman) was hopeful that he would do so at an early date. The report was adopted.

Low Temperature Carbonisation, Ltd.

The annual meeting was held on December 31st, Sir Arthur Wheeler, Bt. (chairman), presiding. In his address the chairman referred to the reorganisation which had taken place during the year, and said that the board comprised, in addition to himself, Messrs. W. H. Behrens, H. Langham-Reed, F. R. Wade, and R. P. Wilson. The new working capital provided by the issue of prior lien debenture stock was £135,000 net. The reconstruction of the Barnsley works was in progress; 160 retorts with a carbonising capacity of 250 tons per day were being erected, and within a few months it should be proved whether the profits anticipated could be realised in actual working practice. One battery of retorts should be in commission by the middle of March, and by the end of May the company hoped to be turning out between 400 and 500 tons of "coalite" and other by-products per week. He had every confidence in the future of the company and the "Parker" process, and claimed that the amount of rich gas which could be produced by the system would have an enormous influence upon the cost of generation of electric power. In conclusion, the chairman said that the company's year ended on July 31st next, and they hoped to issue a report and accounts early in the autumn.

Telephone Co. of Pernambuco, Ltd.

This week the company issued for information only a statement of its capitalisation and objects. The company has a share capital of £200,000, of which £100,000 has been issued. The vendor of the telephone business in Pernambuco received £10,000 in cash and 7,000 ordinary shares of £1 each. Under an agreement made in 1914 with the Pernambuco Tramways and Power Co., Ltd., that company agreed to take up 54,990 7 per cent. cumulative preference shares of £1 each, and in consideration of this the company was allotted 25,000 ordinary shares of £1 each as commission. The authorised debenture capital amounts to £200,000, and of this £150,000 has been issued to the Pernambuco Tramways & Power Co., Ltd., which has received as consideration 13,000 fully-paid ordinary shares.

North Metropolitan Electric Power Supply Co.

The company has decided to redeem the £250,000 8 per cent. cumulative preference stock on July 1st, 1927. It is intended to make an issue of other stock or shares into which he holders of the 8 per cent. stock will be able to exchange their holdings.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Compania de Electricidad de la Provincia de Buenos Aires. Ltd.—131,250 ordinary shares of £2 each, fully paid, Nos. 1 to 131,250.

The undermentioned have been ordered to be officially quoted:—

Compania de Electricidad de la Provincia de Buenos Aires.—131,250 ordinary shares of £2 each, fully paid, Nos. 1 to 131,250.

United River Plate Telephone Co.—152,000 ordinary shares of £5 each, fully paid, Nos. 912,001 to 1,064,000.

Japanese Electric Bond and Share Co.

The American Press reported last week that a company had been formed with the above title, representing Japanese, American, and English interests. The initial capital will be 10 million yen, of which 25 per cent. will be paid up immediately. The parties concerned in the matter are the Tokyo Electric Light Co., the Toho Electric Power Co., the Tokyo Marine and Fire Insurance Co., the Yasuda Holding Co., the Mitsui interests, the Guaranty Co. of New York, the International General Electric Co., the Electric Bond and Share Co., Lazard Bros. & Co. (London and New York), Sale & Co., and the Whitehall Trust.

Yorkshire Electric Power Co.

The company has deposited at the Private Bill Office of the House of Commons a Bill enabling it to increase its authorised capital by £2,000,000 by the creation of new ordinary or preference shares. It is also sought to increase the company's borrowing powers up to one-half of the issued capital.

Simms Motor Units, Ltd.

The directors have contradicted a report, circulated last week, that an offer had been made to purchase the company's shares at prices far in excess of those ruling in the market.

French Companies.

The *Société des Exploitations Electriques* reports net profits of 2,042,000 fr.; the dividend is at the rate of 17 fr. per share.

The *Société Alsacienne et Lorraine d'Electricité* reports net profits of 2,906,000 fr. for 1925-26, as against 2,809,000 fr. in the previous year. A dividend of 8¼ per cent. has been declared.

Greenwood & Batley, Ltd.

An interim dividend of 2½ per cent. has been declared, as in 1922.

Quebec Railway, Light, Heat and Power Co.

A dividend of $1 per common share has been declared.

Stocks and Shares.

MONDAY EVENING.

THE New Year in the Stock Exchange markets opened with a cheerfulness that amounted to something akin to buoyancy in the case of investment stocks. The cause is traceable to the offer by the Government of a new issue of 4 per cent. consolidated stock at what seems to be the relatively high price of 85, such sinking-fund provisions being attached to the loan as render the latter likely to prove generally popular. The immediate effect was to strengthen quotations for existing securities of the gilt-edged order, and this served to impart a strong tone to investment prices in most of the markets. The London Power debenture, for instance, has strengthened to 2 premium, stock still being on offer at 97½ free of stamp and fee, and carrying a three-months' interest payment due on April 1st. The return is the modest one of £5 2s. 6d. per cent. on the money, but the security is irreproachable, and it is stocks which have a character of this description that are in active demand.

During the first week of the New Year it is customary for Stock Exchange prices to exhibit a good deal of strength, owing to the fact that people feel more hopeful on the turning-over of a new leaf, besides feeling themselves released from the necessity of building up big balances at the banks. Later on in the spring there comes into operation the effect of sales made for the purpose of providing money wherewith to meet income tax demands, added to which there arise uncertainties in regard to the Budget. At the moment, however, pointers suggest cheaper money in the near future, and, as already mentioned, markets in most parts of the Stock Exchange are

cheerful, with business amongst investment stocks exhibiting noticeable activity.

The amount of new capital raised in London during 1926 was 230¾ million pounds, as compared with 232 millions in the previous year. Electric light, power and telegraph companies took £.3,667,800 last year, against rather under eight millions in the previous twelve months the final quarter of the year 1926 calling for more money than the rest of the nine months put together. The new issues were taken in most cases with readiness, and in all such instances as those where sound security was offered at a reasonable price, subscription lists were closed in advance of the advertised time.

The New Year has started with indications that more capital will be required before long by some of the electricity supply companies. The East Anglian Electric Supply Company has a Bill to come before Parliament in the next session, the object of which is to extend the supply of electricity within Norfolk, Suffolk, and a large part of Essex. The Yorkshire Electric Power Company's Bill deposited in the House of Commons, proposes to empower the company to raise additional capital to the extent of two million pounds by the issue of ordinary or preference shares. Borrowing powers are also sought to the extent of one-half of the capital raised. The Bognor Gas Light and Coke Company is altering its name to the Bognor Gas & Electricity Company, and Parliament is being asked to grant permission for the company to supply electricity in West Sussex.

Last year's experience showed that, in spite of the demands for new capital, these had little apparent influence upon prices of existing stocks and shares. With the new issues made by manufacturing companies, the fact of the new shares being offered at what are called bonus prices assisted in the rises that occurred in this section. It is expected that several of the electricity supply companies, now that their finances are established upon a firm forty years' basis, will take an early opportunity for spending fresh capital, though the manner in which this will be raised is at present in doubt. It is impossible to imagine that a new authority such as that created by the London Electricity Acts will fail to follow in the familiar footsteps of other similar bodies in the matter of raising money.

Metropolitan Electrics are quoted ex rights, and so are Brompton ordinary, the prices being 26s. and 25s., respectively. No changes have occurred in the list of ordinary shares since the old year. Notting Hill preference at 10 ex dividend have recovered the distribution.

The surprising developments whereby telephonic communication has been established with New York, and the expectation that this will be extended to Australia very shortly, have failed to energise the price of Marconi shares, which remains dull at 13s. 9d. The auditors' investigations are known to be practically complete, and the report should be out before these notes appear. The company has notified that the statements concerning Australian beam service tests are unauthorised, but add that the preliminary tests, so far carried out, have been highly successful.

The cable market at a whole is quiet, with a slight improvement in Globe ordinary to 18¾. The company has declared its usual quarterly dividends of 3s., less tax, on the preference, and 5s. net on the ordinary shares. The Chili Telephone Company announces an interim dividend of 6 per cent. tax free, payable January 15th, the same rate as that of a year ago, and the price remains unchanged at 6¾.

In the manufacturing group, there has been a trifling setback in Johnson & Phillips to 58s. 9d. On the other hand, Metropolitan-Vickers ordinary rose 3s. 9d. to 26s. 3d., upon announcement of some excellent contracts which the company has secured. Edison Swan continue dull, the price going back to 10s. in consequence of the contraction of £17,000 shown in the profit for the year ended June, 1926. Callenders are 1/16th off at 3¾; Henleys fell ¼ to 4¼. The interest recently aroused in the market has subsided to some extent, but prices continue firm as a whole, and there is a steady demand for General Electrics and others of this character. Babcock and Wilcox are better, a fairly general improvement taking place at the opening of the year in the shares of iron, coal and kindred companies. Hopefulness is the pervading note in most of the speeches and messages made by the principal industrialists, and it is felt that justification exists for this, in view of the conclusion of the coal stoppage and the knowledge that business is returning to the country's main arteries of commerce.

The Home Railway market has benefited with the rest. Rises have occurred in Metropolitans, in Districts, and in Underground Electric shares. At the extreme close of last year, an all-round recovery took place in the stocks of the steam railways, but these improvements have not been held in their entirety. The Southern and several of the other railways have in contemplation big schemes of extension, which will involve, it is known, the expenditure of substantial sums upon electrical equipment.

In the foreign group, Brazilian Tractions are better at 108½ and Anglo-Argentine Tramways preference shares, quoted ex dividend, retain the improvements that they secured at the end of last year. A good deal of hesitation is felt in connection with Mexicans. British Columbia Electric stocks met with support, in spite of the slight reduction in the dividend on the preferred. Rubber shares are better, on the whole, thanks to the impression that the price of the raw material will improve if the exportable allowance is again reduced—and there are prospects of such a step being taken—from the beginning of next month.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1924.	1925.	Price Jan. 3 1927.	Rise or fall.	Yield p.c.
Bournemouth and Poole	£ 1	14	14	60/6	—	4 12 7
Brompton Ordinary	1	10	10	25/-xr	—	5 12 0
Charing Cross Ordinary ...	1	15	15	25/-xr	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	25/-	—	5 12 0
City of London	1	15	15	2¼	—	... ...
do. do. 6% Pref. ...	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	28/-	—	5 14 4
County of London	1	15	15	26/-xr	—	... ...
do. do. 6% Pref. ...	1	6	6	22 6xd	—	5 6 8
Edmundson's Ordinary ...	1	7	8	26/9	—	5 19 8
do. 7% Pref.	1	6	7	23/-	—	5 1 9
Elec. Supply Corporation ...	1	10	10	30/6	—	6 11 9
Kensington Ordinary ...	1	15	15	24/-	—	5 16 8
Lancs. Light and Power ...	1	7½	7½	24/-	—	6 2 8
London Electric	1	10	10	24/-xr	—	5 17 8
do. do. 6% Pref. ...	5	6	6	5¾	—	5 11 7
Metropolitan	1	11	11	26/-xr	—	5 7 8
do. 4½% Pref. ...	1	4½	4½	17/-xd	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 9
do. 5% Pref.	1	5	5	17/-xr	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref. ...	10	6	6	10xd	+½	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall ...	5	17½	17½	24/-	—	5 16 8
South London	1	15	15	24/6-xr	—	6 3 0
South Metropolitan Pref. ...	1	7	7	1¼	—	6 3 0
Urban Ordinary	1	4	7	1¼	—	5 17 11
do. 6 % Pref. ...	1	6	6	20/6	—	5 17 1
Westminster Ordinary ...	1	15	15	24/6	—	5 14 3
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	64½	+1½	7 15 0
do. District	,,	3½	3½	58	+1½	6 0 8
Underground Electric	£1	Nil	Nil	12/6	+6d.	Nil
do. do. Income ...	Bonds	6	6	103	—	*5 17 8

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	3	16	2½	—	3 14 4
Chili Telephone	5	5	5	6¾	—	4 7 4
Cuba Sub. Ord.	10	5	5	7	—	7 5 6
Eastern Extension	10	10	10	17½	—	*5 11 4
Eastern Tel. Ord.	Stock	10	10	177½	—	*5 12 1
Globe Tel. and T. Ord.	10	10	10	18¾xd	+¼	*5 7 5
do. do. Pref.	10	6	6	11xd	—	5 9 1
Great Northern Tel.	10	22	20	27	—	7 8 2
Indo-European	25	9½	10	47½	—	*5 5 10
Marconi	1	10	Nil	¼	—	... ...
Marconi-Marine	1	10	7½	1¼	—	6 13 4
Oriental Telephone Ord.	1	12	12	2⅞	—	*4 18 4
United R. Plate Tel.	5	8	8	7¾	—	*5 2 8
Western Telegraph	10	10	10	17½	—	*5 16 0

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2¾xd	—	9 11 4
do. do. 2nd Pref. ...	5	6	6	2¾xd	—	10 18 4
do. do. 5% Deb. ...	Stock	5	5	66½	—	7 12 8
British Electric Traction Ord. ...	,,	7	8	144½	—	5 10 9
do. do. 6% Pref. ...	,,	6	6	109	—	5 10 1
Brazil Traction	100	4	5	108½	+2½	4 12 2
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	88¾	—	5 14 8
do. do. Preferred ...	,,	9/6/-	13/6/9	117¾xd	—	*5 6 8
do. do. Deferred ...	,,	12/9/5	8	146¾xd	—	*5 9 8
do. do. Deb.	,,	4¾	4¾	70½	—	5 8 3
London & Sub. Trac. 5% Pref. ...	1	2½	Nil	7/-	+6d.	Nil
London United Tram. Deb. ...	Stock	4	4	42¼xd	+1½	9 8 4
Mexico Trams, 5% Bonds ...	—	5	5	53½	—	8 0 0
Mexican Light Common	100	Nil	Nil	31½	—	Nil
do. Pref.	100	Nil	Nil	76½	—	Nil
do. 1st Bonds	—	5	5	64½	—	7 15 0
Yorkshire (West Riding)	1	5	—	12/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	12	62/6	—	4 19 1
British Aluminium Ord.	1	5	10	48/-	—	4 3 4
British Elec. Transformer Pref. ...	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	67/6	—	4 9 0
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3¾	—⅛	4 9 0
do. 6½% Pref....	1	6½	6½	23/9xd	+6d.	5 9 5
Crompton Ord.	1	Nil	Nil	10/-	—	... ...
Edison-Swan	£/-	10	10	10/-xd	-1/-	4 0 0
do. 5% Deb.	Stock	5	5	84xd	—	5 19 1
Electric Construction	1	10	10	81/3	—	6 8 0
Enfield Cable Pref.	1	7½	7½	1¼xd	+⅛	6 6 4
English Electric	1	5	Nil	15/-	—	... ...
do. do. Pref.	1	6	6	17/6	—	6 17 9
Gen. Elec. Pref.	1	6½	6½	22/6	—	5 15 7
do. Ord.	1	5	7½	21/-	—	4 16 9
Henley	1	16	20	4¼xd	—¼	4 14 1
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	5	5	1⅛	—	*4 14 1
Johnson & Phillips	1	10	17½	2½	—⅛	5 19 1
Met.-Vickers Ord.	1	8	8	26/3	+3/4	6 2 0
do. Pref.	2	8	8	2⅛	—	6 18 4
Siemens Ord.	1	7½	7½	14	—	5 0 0
Telegraph Construction	12	20	10	29½	—	*4 1 4

*Dividends paid free of Income Tax

The Foreign Electrical Trade of Denmark.

The Last Two Years' Imports and Exports Compared.

THE following table shows Denmark's imports and exports of electrical machinery and apparatus in 1924 and 1925, indicating the principal countries of origin or destination. A note of increases and decreases is also given. Denmark is, on the whole, still more of an importer than an exporter of these goods. She does a very large and growing oversea business in batteries and cells. Imports of machinery declined, while exports of dynamos and motors advanced in 1925, and exceeded the total imports in that class. It will be noticed that although exports of electric wire and cable show fair increases, they are still considerably below the value of imports, which in 1925 marked a very large advance on 1924. Material for lighting installations (switches, fuses, &c.) is still imported in greater quantity than it is exported.

Imports.

	1924. Kr. (1,000).	1925. Kr. (1,000).	Inc. or dec. Kr. (1,000).
Electric cables—			
Total	596	1,506	+ 970
From Germany	400	1,148	+ 748
,, Holland	51	347	+ 296
,, Switzerland	60	(a)	—
Insulated wire—			
Total	1,380	1,904	+ 524
From Germany	553	1,124	+ 571
,, Sweden	100	115	+ 15
,, Holland	416	346	− 70
,, Belgium	126	71	− 55
,, United Kingdom	68	65	− 3
,, United States	61	112	+ 51
Accumulators and plates—			
Total	972	1,135	+ 163
From United States	143	322	+ 179
,, Germany	91	682	+ 591
,, United Kingdom	37	94	+ 57
Installation material (switches, lamp holders, fuses, &c.)—			
Total	1,127	1,518	+ 391
From Germany	968	1,231	+ 263
,, United Kingdom	46	130	+ 84
,, Sweden	57	55	− 2
,, United States	32	46	+ 14
Dynamo lighting sets, ignition magnetos, &c.—			
Total	(a)	595	—
From Germany	(a)	386	—
,, United States	(a)	193	—
Batteries and cells—			
Total	685	870	+ 185
From Germany	460	538	+ 78
,, United States	138	263	+ 125
,, United Kingdom	60	38	− 22
Radio apparatus—			
Total	(a)	3,300	—
From Germany	(a)	1,600	—
,, United Kingdom	(a)	722	—
,, Holland	(a)	473	—
Electrical machinery and apparatus not elsewhere specified—			
Total	1,911	497	−1,414
From Germany	914	297	− 617
,, United Kingdom	334	49	− 285
,, Sweden	382	19	− 363
,, United States	87	94	+ 7
Dynamos, generators, motors, transformers, stators, armatures, rotors, &c.—			
Total	3,816(b)	2,669	−1,147
From Germany	1,500	1,359	− 141
,, United Kingdom	859	518	− 341
,, Sweden	824	146	− 678
,, United States	500	463	− 37
Telephone apparatus—			
Total	396	125	− 271
From Sweden	199	32	− 167
,, Germany	132	66	− 66
,, United Kingdom	39	9	− 30
Electrical measuring instruments—			
Total	827	539	− 288
From Germany	698	491	− 207
,, United Kingdom	62	(a)	—
Other electrical instruments—			
Total (mainly from Germany)	22	49	+ 27

(a) Not separately distinguished.
(b) Vacuum cleaners included in 1924.

Exports.

	1924. Kr. (1,000).	1925. Kr. (1,000).	Inc. or dec. Kr. (1,000).
Electric cables—			
Total	841	1,051	+ 210
To British South Africa	151	312	+ 161
,, Poland	176	270	+ 94
,, Norway	140	120	− 20
,, Sweden	83	141	+ 58
Insulated wire—			
Total	259	297	+ 38
To Holland	72	105	+ 33
,, Belgium	87	67	− 20
Motors and dynamos—			
Total	2,413	2,737	+ 324
To Sweden	228	507	+ 279
,, Great Britain	410	367	− 43
,, Norway	253	277	+ 24
,, France	32	247	+ 215
,, Italy	23	237	+ 214
,, Argentina	83	130	+ 47
,, China	288	188	− 100
,, Asia Minor and Syria	—	110	+ 110
,, Spain	367	67	− 300
Telephone apparatus—			
Total	45	49	+ 4
To Holland	23	—	− 23
Electrical measuring instruments—			
Total	100	61	− 39
To China	39	33	− 6
,, Great Britain	10	10	—
Installation material (switches, lampholders, &c.)—			
Total	1,192	900	− 292
To Sweden	380	322	− 58
,, Belgium	107	128	+ 21
,, Great Britain	43	64	+ 21
,, China	51	65	+ 14
,, Norway	51	70	+ 19
Batteries and cells (including flash-lamps)—			
Total	5,147	6,389	+1,242
To Great Britain	1,293	1,971	+ 678
,, Norway	350	529	+ 179
,, Sweden	724	1,097	+ 373
,, Finland	407	402	− 5
,, Holland	165	176	+ 11
,, Belgium	502	357	− 145
,, Spain	327	535	+ 208
,, Argentina	291	143	− 148
,, British South Africa	167	166	− 1
,, Australia	356	519	+ 163
Electrical machinery and apparatus, not elsewhere specified—			
Total	849	643	− 206
To Great Britain	122	98	− 24
,, Sweden	226	94	− 132
,, Holland	55	97	+ 42
,, China	36	89	+ 53
,, Japan	41	57	+ 16
,, Finland	39	49	+ 10
,, Russia	149	21	− 128
Wireless apparatus—			
Total	(a)	510	—
To Sweden	(a)	218	—
,, Greenland	(a)	118	—
,, Iceland	(a)	59	—
Electrical porcelain goods—			
Total	272	433	+ 161
To Spain	—	114	+ 114
,, Belgium	57	94	+ 37
,, Russia	—	69	+ 69
,, Great Britain	57	62	+ 5
,, Switzerland	86	—	− 86

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

New Mining Switchgear.

A recent production of MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, London, S.E.7, is a new design of mining switchgear of the draw-out pattern, for 300-A loading at 3,300 V. It is made in units arranged for connecting up in switchboard form, and compensation is provided in each bus-bar chamber for any unevenness in the floor levels of adjacent units. The apparatus consists mainly of two parts, the bus-bar chamber and an oil circuit breaker. The former is arranged as a switchboard when a number of units are employed, and as a cable-sealing chamber when only a single unit is used. The oil circuit breaker is equipped with rollers which run on rails to allow the breaker to be withdrawn. Its travel is limited, but it may be lifted from the rails for repairs. The trips are adjusted by a simple device on the top of the breaker, so that it is not necessary to remove the oil tank or main covers to alter the trip settings. Safety interlocking is provided throughout the apparatus, and the usual instruments and automatic features are included. Fig. 1 shows a unit

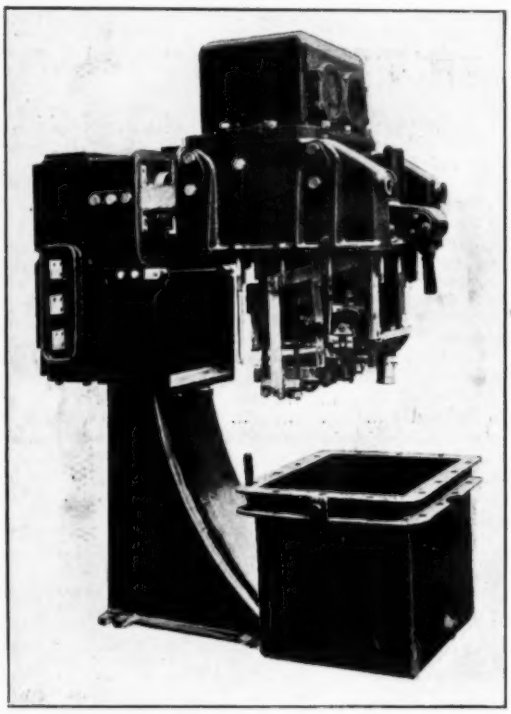


Fig. 1.—Mining Switchgear Unit.

with the breaker withdrawn and the tank removed. Series overload coils with a time-limit attachments can be fitted for any capacity up to the maximum scheduled rating, and self-setting low-voltage releases, or earth leakage trips, may also be provided.

A Motorless Refrigerator.

To assist in meeting the demand for a small refrigerating plant large enough to be of practical use and simple enough to be easily worked by unskilled labour, the PULSOMETER ENGINEERING CO., LTD., Nine Elms Iron Works, Reading, has developed a motorless apparatus, the "Pulsometer" refrigerator, fig. 2. It requires only a small amount of power for heating which can be provided electrically. As there are no moving parts, the equipment has the advantage of being, it is claimed, absolutely silent. The only refrigerating medium is securely confined in the machine, and is claimed to never need replenishing. The only attention required is with regard to the heating and the circulating water; the control of the former is arranged automatically, and the heating circuit is "on" for about 1¼ hours per day. The plant consists merely of a sealed system of containers and pipes, allowing no escape of its contents. The safe is thoroughly heat insulated, and its inside walls are water and damp proof. The apparatus is simple to install, the only requirements being suitable housing, and water and electric connections.

The cooling is effected by the expansion of a certain chemical vapour, dissolved in water, which readily leaves the water on the application of heat, and after it has done its work of cooling is condensed and re-dissolved in the water. On leaving the solution the vapour passes gradually into the special arrangement of pipes fixed inside the safe. When the heating is cut off and the circulation diverted, the cooling period starts. The refrigerant, which has been driven from the boiler into the evaporator in liquid form, then turns into gas and absorbs heat from the cabinet, returning slowly to

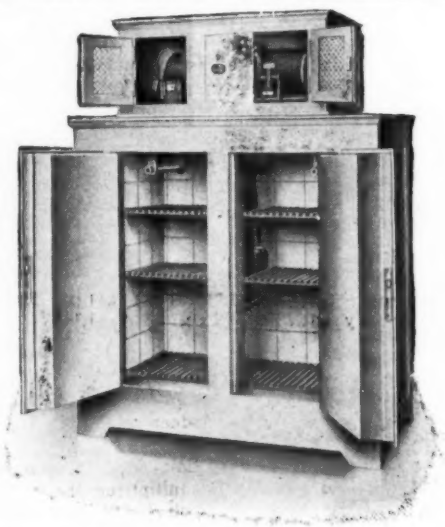


Fig. 2.—"Pulsometer" Refrigerator.

the boiler where it becomes once more absorbed in the original solution. The process of evaporation is gradual, and consequently the cooling continues for a considerable time. Where the advantages of electric heating are denied, other forms of heating can be arranged for.

A Short Rope Drive.

What should prove of interest to the textile industries is a new system of rope drive, the Texrope, introduced by MESSRS. FRANK WIGGLESWORTH & CO., LTD., Shipley, Yorks., which is claimed to permit unusually short distances between the drive centres. It consists essentially of driving and driven sheaves, both V-grooved for a number of Texropes. These are of a specially designed material which acts as a cushioning medium. They are wedge-shaped and stretch slightly so as to pull into the grooves gradually when starting. They do not touch the

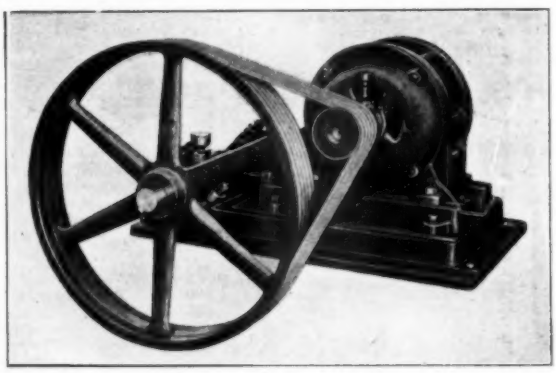


Fig. 3.—A "Texrope" Drive.

bottom of the grooves, being of trapezoidal cross section, so that at high speed no air is trapped to reduce the grip and driving power. These driving mediums are constructed as endless "belts," and are claimed to be more efficient than the ordinary V-belt. Another advantage claimed for this drive is that no lubrication is required, an important feature for drives in such places as food factories. There appears to be no limit to the shortness between the drive centres providing the minimum arc of contact on either sheave is not less than 120 deg. This will no doubt prove a desirable qualification in those cases where direct electric drive is not advisable. Fig. 3 shows a typical Texrope drive.

A Capacitance Bridge and New Inductometer.

A Simple, Self-contained Instrument of Wide Range with a Novel Scale System.

(Abstract of Paper read before the PHYSICAL SOCIETY OF LONDON.)

FOR the accurate measurement of capacitance, Mr. Albert Campbell introduced in 1907 Heydweiller's modification of Carey Foster's method, using as standard a mutual inductometer calibrated against a mutual inductance calculated from its dimensions. This method still holds its place as one of the best for precision measurements of capacitance and power factor, but it requires a rather large set of resistances if a wide range of values is to be dealt with. For tests which do not require the highest accuracy Mr. Campbell has designed a simple self-contained bridge which affords a quick and convenient means of measuring capacitance over a long range, also indicating the power factor with fair accuracy except in extreme cases, and he recently described it in a short paper before the PHYSICAL SOCIETY.

The method consists in placing an unknown condenser C in parallel with a known non-inductive resistance P, and reading the effective self-inductance and resistance of the combination by means of a bridge containing a mutual inductometer; C is obtained directly by multiplying the reading L of the inductometer by $1/P^2$, which factor is conveniently chosen to be some power of 10, so making the scale read the capacitance practically directly. The method has been designed for the convenient determination of capacitance, and treats power factor only as a secondary consideration. If P is not non-inductive, its self-inductance l can be kept so small that corrections are unnecessary in general.

The present model is arranged, as in fig. 1, with equal ratio arms (R=S), P and Q being equal resistances in the other arms, which also include H and K, the two sections of the secondary winding of the mutual inductometer, which are made identical in resistance and self-inductance. The inductometer scale is marked to read L directly, usually extending from −10 to +105 microhenries; the resistances P and Q can be simultaneously altered by a step-switch, giving a series of values, 3.162, 10, 31.62, 100, 316.2 and 1,000 ohms, which give scale ranges of 100$\mu\mu$F, 1,000$\mu\mu$F . . . up to 10 microfarads. Two fixed steps on the inductometer carry each range to three times the above, giving a total range from

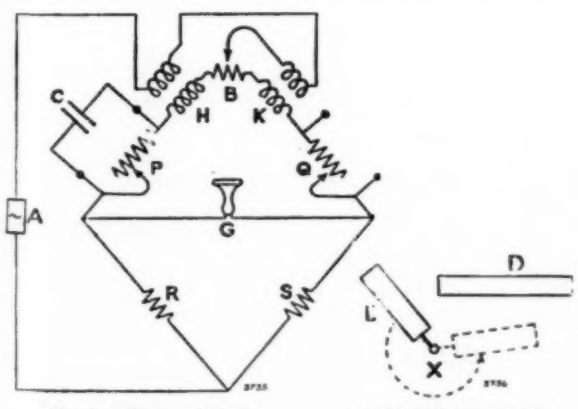


Fig. 1.—Diagram of Bridge.

Fig. 2.—Inductometer, Plan Diagram.

(say) 1$\mu\mu$F to 30μF. The rheostat R has its scale marked to read directly changes in P or Q and can be shunted so as to increase the accuracy of reading tenfold. To make a measurement, the range-setting switch is turned to give the desired range, and a balance (in the telephone or vibration galvanometer G) is obtained by setting R and a small zero-setting L-dial, the main L-dial reading zero. The condenser C is then put across P, and a new balance obtained by altering R and the main inductometer. Then the multiplied inductometer reading gives C, and the change in the rheostat reading gives $(P-P')$, and hence the power factor. Two condensers not very unequal can be compared by putting the larger across P and the smaller across Q.

The instrument, which is made by the Cambridge Instrument Co., is illustrated in fig. 3, and its accuracy of measurement has been greatly increased by the use of a new type of mutual inductometer designed by the author, the scale of

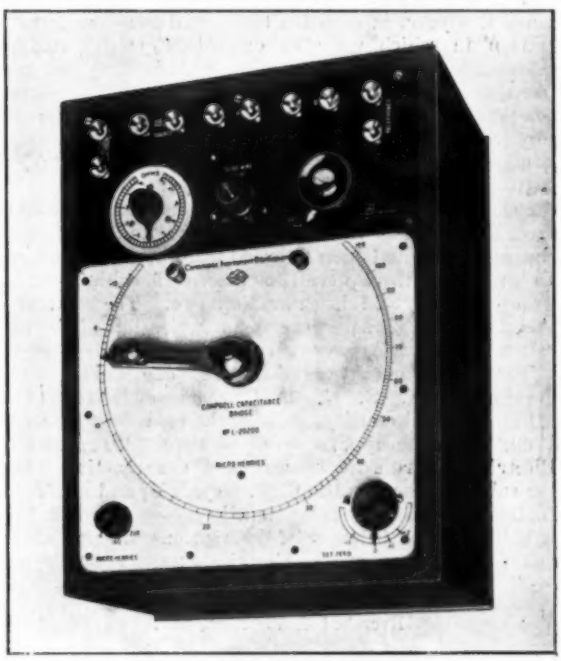


Fig. 3.—Campbell Capacitance Bridge.

which embodies two improvements:—(1) Its angular extent is very great, being about 260 deg., older types giving only about 160 deg. (2) The scale gradually opens out towards the zero, in such a way that over the greater part of the range the percentage accuracy of reading is nearly constant; a slight intentional opening towards the top prevents the divisions being too close there, the minimum length being 1.8 mm. per division.

The importance of constant percentage accuracy of reading does not seem to have been realised by many instrument makers and users, and it is very often difficult to attain. The equation for a scale of constant percentage accuracy is $M=ae^{\theta}$, where M is the mutual inductance at angular reading θ, e the base of natural logarithms, and a a constant; but such a scale could never get down to zero until $\theta=-\infty$. Therefore, a practical scale is closed in gradually at the lower end so as to reach zero and negative values. In the present instance, the ideal scale has been attained by constructing the inductometer as shown in plan in fig. 2, where the fixed and moving circuits are the vertical coils D and E respectively, E being mounted on a vertical axle X, carrying the pointer.

Except at the beginning of the very lowest range, the accuracy of reading of the capacitance bridge is within 2 parts in 1,000 throughout. With the two highest ranges (or for very large power factors) correction is sometimes required; for example, with a frequency of 800 cycles per second for C=1μF., the correction is about 2 in 1,000, and for C=30μF it becomes quite excessive. This difficulty with very large condensers can be avoided by making the tests at a lower frequency, such as 100 cycles per second. In conclusion, it may be remarked that the system of shunting used in the bridge involves considerable loss of sensitivity, but this disadvantage appears to be well outweighed by the convenience and ease of working of the instrument.

The Physical Society's Exhibition.

Annual Display of Electrical Instruments and Scientific Apparatus.

THIS eagerly-looked-forward-to show was held as usual at the Imperial College of Science and Technology, South Kensington (January 4th, 5th and 6th). It was the seventeenth of the series of annual exhibitions arranged by the Physical Society of London, and the Optical Society, to indicate the year's developments in the design and manufacture of electrical, optical, and other physical apparatus, being accordingly hailed as one of the chief scientific events of the season.

The Councils of both Societies decided to again include this year, in addition to the well-established trade section in which some 74 exhibitors participated, a research and experimental section similar to that successfully initiated in 1926. The groups in this section comprised: (*a*) Exhibits illustrating the results of recent physical research and improvements in laboratory practice; (*b*) effective lecture experiments; and (*c*) repetitions of famous historical experiments, for which accommodation had been provided in rooms distinct from those devoted to the trade exhibits, and a section of the catalogue had been allotted for their description. In group (*a*) there were this season 19 exhibitors; in group (*b*), 11; and in group (c), two. The total was, therefore, 116, which figure is an indication of the size of the display.

Three discourses were delivered, one during each evening: Prof. E. N. da C. Andrade lectured on "Light and Electricity, as it might have been given in 1709," with the apparatus of the time. "Progress in Electrical Instrument Design and Construction" was the subject chosen by Dr. C. V. Drysdale; and Mr. John L. Baird spoke on "Television."

We commence below brief descriptions of some of the newer apparatus of an electrical nature which was exhibited in the trade section.

Evershed & Vignoles, Ltd.

Chief amongst the new instruments and improved devices shown by this Company was the Midworth distant repeater, an electrically-operated system which enables movements as different in character as the motion of a sluice gate, lever arm, or instrument pointer, to be shown at any distance and at any number of points; it can also be used for the distant control of any power-driven apparatus, and any number of repeating instruments, either indicating, recording, integrating, or controlling can be used. The actual transmission is of an angular motion, and normally the repeating instruments also show a corresponding angular deflection. Where a movement in a straight line is to be repeated, it is therefore converted into angular motion; if, however, it is desired to repeat the original movement exactly, appropriate arrangements can be made at the repeating station.

The operation of the system imposes no load on the apparatus of which the movements or indications are to be indicated or recorded, a valuable feature where the readings of a delicate instrument have to be transmitted to a distance. It does not operate on the step-by-step principle, and the repeating instruments cannot get out of step with the transmitter, whilst for transmitting information by means of indicating or recording instruments, it requires two conductors only between transmitter and repeating instruments.

The apparatus automatically compensates for variations in the supply voltage and for changes in the resistance of the repeater circuit; the line connecting transmitter and repeating instruments may therefore be of any length desired, and the number of repeating instruments used may be varied at will without affecting the accuracy of the system. In the event of line breakage, the apparatus returns automatically to normal working without loss of accuracy when the break is repaired. The repeating instruments are milliammeters, which are inexpensive.

The principle underlying the system is the regulation, by the originating movement, of an electrical current which passes through the controlling and repeating instruments in series; below the main index, and mounted in axial alignment with it, is the pointer of the electrical control instrument, which floats between two contacts borne on the main index; when the latter moves in response to the originating movement with which it is connected, one of the contacts which it carries touches the pointer of the control instrument and completes the circuit of one of two field coils of the control motor. The field coil being energised, closes a switch in the armature circuit of the control motor, at the same time releasing a brake which normally prevents the armature from revolving; the armature then turns worm gearing which moves the contactor arm over the control rheostat (see fig. 1); the direction in which the arm is moved depends on which field coil has been energised. As the arm moves over the rheostat, the current passing through the repeater and control instrument circuit is altered until the pointer of the control instrument reaches a position at which it floats freely between the contacts carried by the main index, when the field-coil circuit is broken, the motor is switched off, and the armature is stopped instantaneously by the releasing of the brake. The control mechanism operates therefore to bring the current through the control instrument to such a value that its

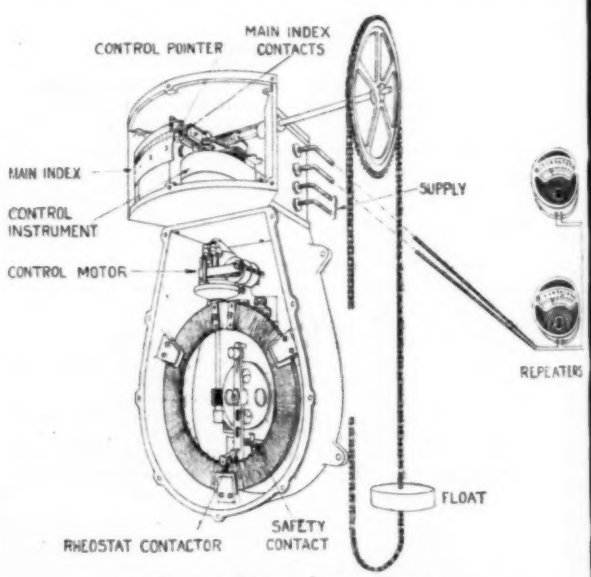


Fig. 1.—Midworth Distant Repeater.

angular deflection corresponds with that of the main index, and as the control and repeating instruments are in series, the pointers of the repeaters will follow wherever the main index may be moved.

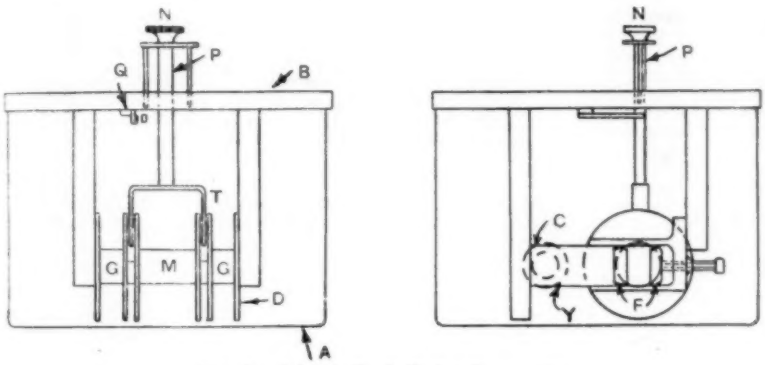
As the mechanism tends always to bring the system to a state of balance with the pointer of the control instrument and the main index in alignment and the motor at rest, it is evident that when equilibrium is attained there can be no load on the main index; hence the system can be used for repeating the indications of delicate instruments at a distance. Should the voltage of the repeater circuit vary, the current will fall and the control pointer will touch one of the contacts on the main index; the motor will rotate the rheostat contactor in the direction necessary to restore the current through the repeater circuit to its correct value until the pointer once more floats freely. Changes in the resistance are similarly compensated for, so the number of repeating instruments can be varied at will. In the event of a break in the line, the control motor will try to make up for the insertion of resistance of infinite value, and will rotate the rheostat until a safety contact is touched, when the system is closed down. The circuit through the other field coil, that which causes the motor to turn the contactor arm so as to reduce the current, is, however, left ready so that when the line is restored, the motor immediately starts, and the reading returns to its correct value.

Should the rheostat or contactor become corroded, the arm will oscillate until the dirt has been removed. The con-

tacts of the main index carry only the small current necessary to energise the field coils; they are therefore not subject to sparking or to rapid wear. The full line voltage is always across these contacts, and they are thus not susceptible to imperfect contact. All contacts are readily detachable, and the rheostat can be easily removed without undoing any wire. The motor is of simple design, and the power consumption for the entire installation is from 10 to 12 watts only. The system as at present designed works on direct current, and its varied possible applications indicate its wide range of usefulness.

Cambridge Instrument Co., Ltd.

Amongst a number of new instruments shown was the useful and simple Campbell capacitance bridge, which is described fully on page 31 in this issue. Another piece of apparatus was the Hughes permeameter for accurately determining the magnetisation curve and hysteresis loop of bars of magnetic material. The complete outfit consists of a bridge, resistance



Figs. 2 and 3.—A Simple Hughes Permeameter.

and switch unit, ballistic galvanometer, resistance box, and a multi-range ammeter. The main magnetising coil is so arranged that H equals 100 times the current in amperes, and it is designed to carry up to 4 A in air, or up to 10 A in oil; values of H from 1 to 1,000 c.g.s. units may be measured with tolerable accuracy. The bridge (figs. 2 and 3) consists of an aluminium tank A with an ebonite lid B supporting the yokes Y and the compensating and magnetising windings C M; the specimen is passed through the brass spool D and clamped across the two yokes by F. The spool D has a slot on each side of the magnetising winding to allow the test yoke T to approach the specimen. Two guard windings G maintain an even distribution of flux in the specimen, and provision is made so that the test yoke may be reversed in order to test for complete demagnetisation of the test yoke. A switch is arranged to automatically short circuit the resistance in the galvanometer circuit when testing for magnetic balance. The arrangement enables the windings of the specimen to be immersed in oil when working at the higher values of the magnetising force, by filling the aluminium case with oil. This simple form of apparatus enables commercial bar specimens of magnetic material to be tested by standard methods with a precision equal to that of the ring method, without necessitating the provision of a perfect magnetic joint at the ends of the specimen, and without winding any special coils on the specimen other than the search coil. The range of the apparatus may be readily extended to the measurement of permeability, and the determination of the hysteresis loop at high values of the magnetising force. The precision of the results obtained is such that for any but abnormally low values of H, the errors do not exceed 1 or 2 per cent., while for higher values of H (up to 1,000 c.g.s. units) the accuracy is proportionately increased.

An improved form of thermionic voltmeter is similar to the original model developed by Mr. E. B. Moullin, but is a multi-range pattern suitable for a wider range of measurement.

A simple form of thread recorder (fig. 4) for use with base metal thermo-couples is expected to have a large sale. It possesses the essential features of the standard Cambridge thread recorders, but can only be supplied as a single-point instrument and in one of the following ranges:—0 to 600 deg. C., or 0 to 800 deg. C. for use with iron-constantan thermo-couples, and 0 to 1,000 deg. C., or 0 to 1,200 deg. C. for use with "Titan" thermo-couples. The galvanometer is a robust pivoted-coil instrument and the record is traced on a 25-hour chart with a record space 95 millimetres wide; the mechanism is enclosed in a metal case.

A continuous film micro-indicator, which was made for the London & North-Eastern Railway, was shown by courtesy of the chief mechanical engineer. It is a modified form of the indicator designed by Mr. W. G. Collins, by which diagrams are obtained from high-speed engines by means of a stylus acting upon the surface of a celluloid disk; the continuous-film instrument has been designed primarily for use on locomotives, and the controlling switchgear may be fixed in any suitable position to enable the records to be obtained from a distance.

A new illuminated indicator has been designed to meet the demand for a large-dial instrument which can be easily read from a considerable distance, and the first model has been developed for use with CO_2 meters. One of these indicators is mounted on each boiler and connected to a katharometer in the ordinary way: the movement of the pointer is controlled from a galvanometer, which forms a separate unit, and is common to all the indicators (up to six) in an installation, being connected to each in turn through a master switch. The apparatus can be linked to an ordinary multi-point thread recorder installed in any convenient position. The indicator has a 13-in. dial with large figures, and contains no delicate mechanism; the scale is graduated in CO_2 percentage, the standard range being 0 to 18 per cent. A circular area on the portion of the scale to which the pointer is directed at any moment is illuminated by white light, while the pointer itself is illuminated by green light, if the percentage of the CO_2 is increasing, and by red light if it is decreasing. The operation may be briefly described as follows:—A pendulum contact-maker continually makes and breaks an electric circuit, and thus operates two electro-magnets: one operates the master switch, while the other operates a chopper-bar mechanism, which depresses the galvanometer pointer at regular intervals on to one of the two contacts, depending upon the direction of its deflection; by its rotation the master switch connects each CO_2 meter in turn (for a definite period) to the corresponding indicator and to the galvanometer. When there is a change in the CO_2 percentage in a flue, the galvanometer pointer will be deflected and, when it is depressed by the chopper bar, it will close an electric circuit which energises one of two electromagnetically-operated pawl and ratchet mechanisms in the indicator, and thus rotates the indicator pointer in the corresponding direction. As the pointer rotates, a contact arm is moved over a circular rheostat and so rebalances the Wheatstone bridge circuit. When the illuminated pointer moves up and down the scale, a green or red screen is automatically introduced into the path of the light which illuminates the pointer.

Marconiphone Co., Ltd.

Units for supplying high plate voltage for radio receivers and amplifiers from d.c. or a.c. mains were on view. They are designed to work on 100 to 120 or 200 to 250-volt mains, giving outputs at 120, 80, and 40 volts, so that any supply and any receiver may be suited. The U.5 full-wave rectifying valve is used in the a.c. unit, which has an output of 50 mA. The d.c. unit has a switching arrangement for reversing the smoothing circuit in cases where the positive main is earthed. This feature is not generally provided, and is a point worthy of note, as the efficiency of the smoothing effect may otherwise be seriously affected.

A new 2-volt power valve, the DEP.215, consumes only 0.15 ampere at 2 volts, and has the remarkably high

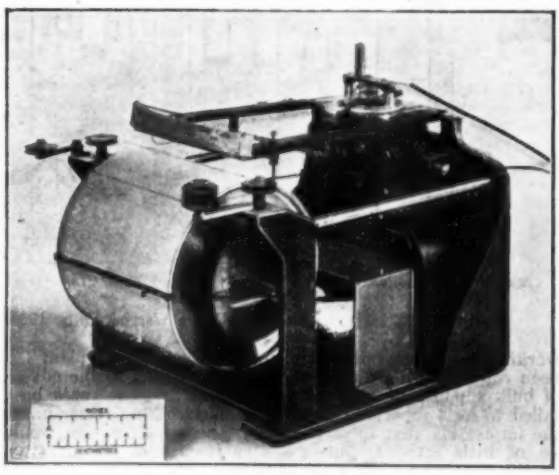


Fig. 4.—A "Cambridge" Thread Recorder.

mutual conductance of at least 1,000 micromhos. The amplification factor is 6.25, and the impedance is given as 6,250 ohms, but is generally below this figure. The maximum output is therefore very high, being 126 milliwatts of undistorted energy, at 120 volts h.p. The efficiency, expressed in microhms per watt of filament consumption, is 3,330.

The new supersonic transformer, with a natural wavelength of 6,500 metres, is worth attention. It is of the open iron-core type designed to give as sharp a cut-off as possible consistent with good amplification over a band of 5,000 cycles on either side of the fundamental frequency, with a step-up of about three and a half. The result is that reproduction is excellent, no filter is required, and two intermediate frequency stages are sufficient for all practical purposes.

(To be continued.)

Heavy-Oil-Engine Working Costs.

Diesel Engine Users' Association's Report for the Year 1925-26.—*Abstract.*

THE report of the General Committee of the Diesel Engine Users' Association on the working costs of Diesel engine and other heavy-oil-engine installations for 1925-26 has been published. In view of the interest which is being taken at present in the working costs of prime movers for the generation of electricity throughout the country, the figures and graphical representation of the results (fig. 1) which accompany the report are receiving particular attention. It should, of course, be noted that the average cost is obtained from undertakings in the majority of which the conditions of working are by no means favourable to securing the best results, and that the average figures do not represent the results obtainable when operating under reasonably favourable conditions. In some of the undertakings the heavy-oil-engine plant is only used as a stand-by, and in a large number of cases the annual plant load factor is less than 15 per cent.

In presenting the report, the Committee explains that the list of stations has been maintained practically intact and average figures over a period of four consecutive years' working are now available in many cases. Where plant has been run very little during the past year owing to the advent of bulk supplies of electricity, engineers in some cases have failed to send reports of their oil-engine working costs, under the impression that in such circumstances their figures would be of little interest; but the very reverse of this is true, as the Committee aims at collecting information under as great a variety of working conditions as possible.

Among the 46 undertakings listed (37 Home and 9 overseas) six new engines, varying in size from 250 to 1,125 b.h.p., were installed during the year, the average size having been 750 b.h.p.; the average size of engine installed during the previous year was 500 b.h.p.; the tendency to adopt larger engines therefore continues. There has naturally been an increase in the average plant capacity per station, and it is satisfactory to note that the average cost of repairs and maintenance per kilowatt installed is steadily falling in consequence. The average engine cost per unit generated among the home stations improved from 0.806d. to 0.799d., notwithstanding a slightly increased price for fuel oil and a slightly less favourable running-plant load factor. Among the overseas stations the corresponding figure increased from 0.746d. to 0.753d., the rise having corresponded exactly with the higher price paid for fuel oil; in this case also there was a slight diminution in the running-plant load factor.

Engine Costs.—Taking the 37 home stations, the average engine cost per unit generated in the year was 0.799d., see Table I.

TABLE I.—*Engine Cost per Unit Generated.*

	Pence.	Percentage of Total Engine Cost.
Fuel	0.387	48.40
Lubricating oil	0.057	7.13
Water (including treatment) ...	0.011	1.38
Stores	0.007	0.88
Wages (running staff)	0.200	25.10
Repairs and maintenance	0.137	17.11
	0.799	100.00

Output.—The total output reported upon has increased by 8,800,000 units, equivalent to 17.2 per cent. of the previous year's output.

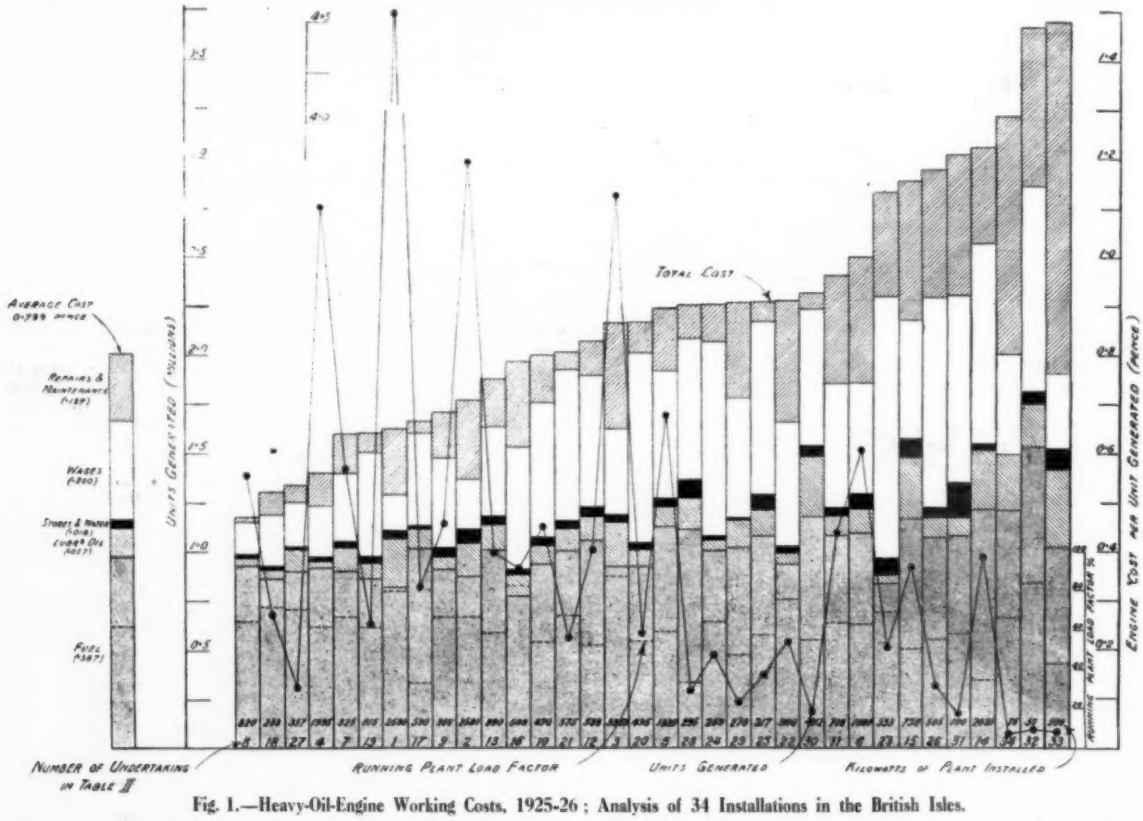


Fig. 1.—Heavy-Oil-Engine Working Costs, 1925-26; Analysis of 34 Installations in the British Isles.

Plant Installed.—The increase in plant installed during the year among the stations listed was 3,100 kW. The increased average plant capacity per station [Home 788 kW (703 kW previous year), overseas 1,510 kW (1,270); total engine capacity, Home 29,141 kW (25,363), overseas 13,550 kW (10,193)] has a bearing on the reduction in the repairs and maintenance cost per kilowatt installed and per unit generated.

Thermal Efficiency and Fuel Consumption.—Taking the average gross calorific value of the fuel oil used at 19,500 B.th.u. per lb., the overall thermal efficiency of the 46 stations employing 177 engines (varying in size from 1,125 to 60 b.h.p.) run at an average running-plant load factor of 60.1 per cent. was 24.15 per cent. This is a slightly better result, and at a slightly lower running-plant load factor, than was obtained in the previous year. The average fuel consumption per unit generated, 0.725 lb., is about 7.8 per cent. above the corresponding value on the standard curve; the excess recorded in the previous year was 9.1 per cent., while for 1923-24 the excess consumption was 10 per cent. Twenty-one undertakings returned fuel consumptions which fall on or below a line drawn at 5 per cent. above the reference curve; the best results in this respect were obtained by the Chiswick Electricity Supply Corporation, the Maidenhead Corporation, Birkdale District Electric Supply Co., the Buxton Corporation, the Alderley and Wilmslow Electric Supply Co., the Bognor Gas

and Electric Co., the Electric Supply Corporation (Hitchin station), the Cookham and District Electricity Corporation, and the Kastoorchand Mills Co. (Bombay, India). These undertakings scored fuel consumptions below the reference curve, which several of them have done consistently during the last three years; from the last-mentioned fact arises the request for information to be supplied in future as to the brand of fuel oil used, and in view of the foregoing there seems to be no reason for altering the standard of reference.

Lubrication.—The average consumption of lubricating oil per unit generated, 0.00154 gallon, shows an improvement of about 9.4 per cent. The average improvement among the Home stations was about 4.5 per cent., and overseas 16 per cent.; the Home stations' average improvement does not reflect the economies which have been effected by a majority of the stations owing to the heavy consumptions of the Charing Cross and Southend undertakings, which bulk largely in the total lubricating oil used (accounting for 25,800 out of a total of 553,800 gallons). As a matter of fact, very much better results than formerly have been obtained by many Home stations; the average consumption of 33 of them was 0.00114 gallon per unit generated, at an average running-plant load factor of 57.8 per cent; this figure approaches fairly nearly to the working standard curve. A large number of stations have adopted centrifugal machines for oil cleaning with beneficial results.

Maintenance.—The average maintenance cost per unit generated, 0.137d. for Home stations, and 0.116d. overseas, shows a further substantial reduction in comparison with the corresponding figures for previous years, although a slight fall in the respective annual plant load factors has been recorded. Among the Home stations listed 127 engines (varying from 50 to 1,125 b.h.p.), and among the overseas stations 50 engines (varying from 100 to 1,050 b.h.p.) were in use during the year. The development of new types of engines of larger capacity than formerly usual necessitates the gradual solution of special problems in design, and a temporary setback with regard to this item of working cost might have been experienced, but many examples of the newer engines have given such favourable service that there is no doubt that a definite advance in oil-engine development has been made. Maintenance costs which have been collected during the last four years are being scrutinised along new lines, and the Committee would welcome a free discussion and suggestions on this matter from the members. It is felt that the investigation into this item of cost has been really useful so far as it has gone, but a great deal of work and a combined effort on the part of all members is necessary for carrying it to complete success.

The Co-ordination of Urban Transport.*

The Desirability of Unified Management and Common Financial Interest.

By the Rt. Hon. **LORD ASHFIELD,**

(Chairman and Managing Director of Underground Electric Railways of London, and other Companies.)

URBAN transport is a complex subject. The means of travel required to conduct it satisfactorily are many and varied; the volume of traffic to be dealt with continually outstrips the capacity of the services provided, and the margin between receipts and expenses is always narrow in relation to the demands made upon it by reason of the large capital costs involved.

The underlying principles which may govern the operation of such undertakings are three, contrasted and opposed, namely, competition, co-ordination, and monopoly. "Laisser faire" and competition are but two aspects of the unrestricted freedom which the earliest economists deemed essential to the public welfare. The doctrine of the other extreme, of socialism as the negation of competition, found its dominant utterance later; out of evolution, however, the idea of co-ordination started, but there is still the same lip service by large sections of the community, the notion that competition alone is essential and beneficial and advantageous.

In 1860 the urban passenger movement in Greater London, using purely local means of transport, amounted to 40 millions of passengers. Twenty years later it had multiplied six-fold, and twenty years later still (in 1900) twenty-fold; it continued to advance with ever-accelerating speed, for in 1925 it amounted to 3,225 millions of passengers, or an accumulative increase of 8,000 per cent.; by 1930 it will be within reach of 10,000 per cent. Greater New York affords an almost parallel series of results, and one of the most illuminating comments on this record is that in a modern metropolis it is impossible to catch up with the demand for transport, because every addition to the means of transport creates fresh traffic and, therefore, fresh congestion. There is much truth in this which points, not to competition between the means of transport, but rather to competition between the users of the service of transport, a quite novel aspect of the blessed process. Apart from this radical change in the scale or magnitude of the problem, there has been the revolution wrought by electricity and the counter-revolution of the internal-combustion engine. It is time the new problems were approached as new problems, and not merely as overgrown old ones.

Transport consists in public service. The service may be measured statistically in seat-miles; the use of the service may be measured in passenger-miles: if the seat-miles are not used by passengers and so converted into passenger-miles, they are lost. The provision of service must be distinguished from the provision of commodities: if commodities are not sold one day, unless they are perishable, they may be sold the next; but service, once provided, is wasted unless it is used. The whole service must be paid for out of the proceeds of the part which is used, and a substantial proportion of the total service provided is wasted in any event by the operating conditions occasioned by the variable flow of the traffic. Whether railways, or tramways, or motor-omnibuses are considered, in Greater London the average use which is made of the facilities provided barely exceeds 33 per cent. In the cities of America it will not be greater; it may easily be worse. Only by unified management of all the means of transport and their co-ordination into a general system can such unavoidable waste as there is be reduced to the minimum compatible with adequate and efficient service to the public; but transport is not a simple service: express railways are required to connect outer suburbs with the centre; ordinary railways with high-speed stopping trains are required to connect the inner suburbs with the centre; the streets are filled with motor-cars and omnibuses; to cope with heavy short-distance traffic, street railways or tramways are needed upon which units of two or three coupled cars may rapidly clear away the in-flow and out-flow from factories, stores, and offices. The demands for service are varied, and the means of transport must become equally varied to meet the demands. Competition of one kind of service with another grows up which needs regulation and control, for the economic or profit-earning capacity of the different kinds of service is unequal.

In Greater London the average speed of the underground trains is 18 miles per hour, including stops, or 24 miles per hour where a limited number of stops only is made; of the tramways, the average speed is 9.6 miles per hour, but of the motor-omnibuses in the built-up areas it is only 8.6 miles per hour.

Average receipts per passenger upon the underground railways are 2.8d., upon the omnibuses 1.8d., and upon the tramways slightly less than 1.45d.; but the average cost of carrying a passenger upon the underground railways is 2.1d., upon the omnibuses 1.6d., and upon the tramways 1.3d., so that the margins (net receipts) are respectively 0.7d., 0.2d., and 0.15d. per passenger. Their relative net earning capacities (if the railways are taken as 100) are 29 in the case of the omnibuses and 21 in the case of the tramways, and the capital investment involved in the provision of these several forms of transport represents, per passenger carried in the year, 34d. in the case of the underground railways, 5d. in the case of tramways, and 1.4d. in the case of motor-omnibuses. Then, if the net receipts per passenger are brought into relation to the capital expenditure per passenger, it will be found that (motor-omnibuses being taken as 100) the economic capacity of the tramways is only 21, and of the underground railways (on account of their enormous capital expenditure) only 15.

Yet all these means of transport are necessary to a complete scheme of facilities. Under competition, free and unrestrained, the motor-omnibus must develop at the expense of tramway and railway, but this cannot be contemplated,

*Paper prepared for the Electric Railway Association Convention, Cleveland, Ohio, U.S.A., October, 1926.—*Abstract.*

so once more co-ordination must take the place of competition, and, added to unified management, there must be common financial interest which will permit of the strong aiding the weak, so that all may continue to expand and improve as may be necessary to give the public satisfaction. No form of transport dare confine itself to catering for one class, if by catering for several classes it could secure more passengers in the aggregate; tramways and omnibuses both seek the short-distance passenger and, in the main, give equivalent services at equivalent prices; railways cease to develop express services in favour of stopping services because they secure better loadings. In effect, competition is destroying the effectiveness of the transport facilities provided.

Developments since 1860 have proved that competition is no longer applicable to urban transport, but is the only alternative monopoly in one or another of its forms? It is suggested that co-ordination is a golden mean.

Those who manage and control joint stock companies have built up a technique of management which they must observe conscientiously. Undertakings now stand or fall by good management, and the weakness of the present economic situation is the absence of a sufficient supply of good managers. Finally, and may be most important than all else, publicity has entered into management. What is done in the office is shouted in the Press. The basis of prosperity in urban transport is not a few passengers at high fares, but many passengers at low fares.

What is meant by co-ordination? There is no one answer to such a question; each city must work out its own. It does not necessarily involve all transport agencies being in one ownership, or all transport agencies being under one management for the routine discharge of their operations, but there must be the power and authority to ensure that the operations of all the transport agencies are knit together into a systematic whole, to readjust the financial positions of conflicting agencies, to ensure that (whatever their ability to earn may be) all receive according to their needs, if their service is required. In some cities an independent board may be set up for the purpose, as in Boston; in others the transport agencies may be amalgamated and managed as one, under private auspices, as in Cleveland; in other cities a judicial body may decide between conflicting parties, and a semblance of direct competition remain, as in New York. In all cities the people have the right to exercise control, subject to the observance of certain principles. First, that those who control shall not be interested in one transport agency more than in another; secondly, that the transport agencies as a whole shall be self-supporting, or if that is not to be the case because cheap transport is held in such esteem as to warrant a tax or impost on the community in some other shape, such as a charge on landed estates, a rate on property, or a levy on industry at large, then a definite policy of subsidy out of such other resources shall be defined; thirdly, that those who invest their money in urban transport shall be entitled to a reasonable and proper return upon their capital. If, however, those who are engaged in the provision of urban transport are neglectful, or dilatory, or unreasonable, then the door should be opened and fresh agencies invited to take a share. Co-ordination is conditional protection depending upon deserts. The case for co-ordination has, since the war of 1914-1918, been reinforced by the tendency of events in almost all the great cities of the world. In Paris, Berlin, and New York there is a combination of public ownership with private operation. In Cleveland the celebrated plan of "service at cost" was instituted in 1910, and, with minor modifications, has been copied in many cities. This was a pioneer adventure in management on modern lines, and laid down a basis under which private ownership and public interests could be harmonised and the advantage of individual effort and skill placed at the disposal of the public and shareholders. The root plan is an agreement between the municipality and the transport undertakings which guarantees to the latter financial security in return for the best service possible, having regard to the economic conditions under which the transport facilities must be operated. The plan has been tested for years and still shows scarcely a flaw. Wherever search may be made, the tendency is always the same, yet London lags behind. However, a business influence is spreading, and it is hoped to establish common management of all transport undertakings in Greater London.

The Electricity (Supply) Act, 1926.

A Summary of its Provisions.

(*Continued from page* 1098.)

9.—(1) The Board may require any authorised undertakers or the owners of any selected station to amend or alter the frequency employed in their undertaking or station, if and so far as such amendment or alteration is required to effect the standardisation of frequency provided by a scheme, or to effect such standardisation of frequency as the Board, with the approval of the Electricity Commissioners, may think expedient, subject to the payment of any expenses incurred in carrying such requirements into effect (including the cost of altering or replacing plant belonging to consumers), and the Board shall, if required, advance free of interest such sums as may be necessary.

(2) The payment of any such expenses and the making of such advances shall be purposes for which the Board may borrow.

(3) The Board shall be entitled to be repaid by the Electricity Commissioners in each year the sums required to meet the interest and sinking fund charges in respect of money so borrowed.

(4) Any question regarding expenses shall, in default of agreement, be determined by the Electricity Commissioners or at the option of the authorised undertakers or owners be referred to arbitration.

(5) A railway company shall not be required to alter the frequency employed by them except by an Order made in accordance with the Railways Act, 1921.

10.—(1) As soon as the Board, as respects any area or part of an area, notify that they are in a position to supply electricity, they shall be under an obligation to supply it to any authorised undertakers in that area demanding such a supply.

Provided that the Board shall not supply electricity directly to authorised undertakers situated in the area of supply of a power company without the consent of the company unless the undertakers have an absolute right of veto on any right of the power company to supply electricity within the area of supply of those undertakers; or unless the power company are unable or unwilling to supply electricity to such authorised undertakers on reasonable terms and conditions, to be determined in case of dispute by the Electricity Commissioners.

(2) Where it appears to the Board that the outlay incurred in providing the transmission lines required would entail unreasonable expense, the Commissioners may authorise the Board to impose such terms and conditions as the Commissioners may think fit, on the giving of the supply.

(3) Where any authorised undertakers owning a generating station, not being a selected station, demand a supply of electricity, they shall take the whole quantity of electricity required for their undertaking, directly or indirectly, from the Board.

Provided that—

(*a*) The Board shall not impose such a condition unless satisfied that the cost per unit to the undertakers will for a period of not less than seven years be less than the cost at which electricity is then being produced at the generating station of the undertakers, and in determining such cost no account shall be taken of capital charges in respect of capital expended on the station; and

(*b*) Where the authorised undertakers feel aggrieved they may appeal to the Electricity Commissioners, who shall, if so requested by the undertakers, refer that question to arbitration;

(*c*) Where the Board impose such a condition they shall take over the obligations of any such undertakers to receive supplies of electricity in bulk.

11.—(1) Subject to the provisions of this Act as to the sale of electricity to the owners of selected stations, the price to be charged by the Board for electricity supplied directly by them to authorised undertakers shall be in accordance with such tariff as may be fixed by the Board from time to time, and the tariff shall be fixed so that over a term of years to be approved by the Electricity Commissioners the receipts on income account shall be sufficient to cover the expenditure on income account, including interest and sinking fund charges, with such margin as the Electricity Commissioners may allow.

(2) The tariff shall be so framed as to include as part of the charge and show separately—

(*a*) A fixed kilowatt charges component;

(*b*) A running charges component:

in accordance with such principles as may be approved by the Electricity Commissioners:

Provided that an order of the Electricity Commissioners under this subsection shall not come into force until it has been laid before each House of Parliament for thirty days.

(3) The tariff fixed under this section may be different for different areas.

12.—Where any authorised undertakers take a supply of electricity from the Board, the price charged by them for the supply of electricity in bulk to other authorised undertakers, or to a railway company, shall be on the same terms as those on which the undertakers receive the supply from the Board, together with charges in respect of any transmission line used for the purpose.

13.—Where the owners of a selected station, who take a supply of electricity from the Board, prove to the satisfaction of the Electricity Commissioners that the cost of taking that supply in any year exceeds the cost which they would have incurred, had this Act not been passed, in themselves generating the like quantity of electricity, then the charges by the Board to those undertakers shall be so adjusted that the amount charged in that year does not exceed the cost which, in the opinion of the Electricity Commissioners, the undertakers would have incurred.

14.—(1) Where the Board notify any authorised undertakers owing a generating station, not being a selected station, that the Board are in a position to supply them with such quantity of electricity as they would require if the station were closed, and undertake to give such a supply for a period of not less than seven years on specified terms, and are satisfied that the cost of the supply on those terms is below the then prevailing cost of generating electricity at the station, and those undertakers refuse to take such supply from the Board, then, if the Electricity Commissioners are satisfied as respects the next subsequent year that the cost of production of electricity at the station substantially exceeded the cost they would have incurred had they purchased the like quantity of electricity from the Board, the Commissioners may by order require the undertakers to take a supply of electricity in bulk from the Board and shut down the generating station as such.

(2) If any question arises under this section as to the cost of production it shall, if the undertakers so require, be referred to arbitration.

(3) In calculating for the purposes of this section the cost of production of electricity generated by the authorised undertakers, no account shall be taken of capital charges in respect of capital expended on the generating station.

(4) For the purposes of this section, any authorised undertakers owning a generating station (not being a selected station) shall, on being so required by the Electricity Commissioners, furnish them with a statement showing the cost of production of electricity at that station.

15.—Section sixteen of the Electricity (Supply) Act, 1919, as amended by section twenty-one of the Electricity (Supply) Act, 1922, shall, with the necessary adaptations, apply to any officer or servant of any authorised undertakers affected by the closing (permanent or temporary) or restrictions imposed by the Board or by or under a scheme on the working or use of or the acquisition of a generating station, or the acquisition of a main transmission line or any part thereof, under or in consequence of this Act, as set out in the Fourth Schedule to this Act.

16.—(1) Where under this Act the Board are authorised or required to enter into arrangements with authorised undertakers for any purpose it shall be lawful for the undertakers to enter into and carry out such arrangements.

(2) The carrying out of such arrangements shall be a purpose for which authorised undertakers, being a local authority or a joint electricity authority, may borrow.

(3) Where the carrying out of any such arrangement by authorised undertakers, being a company, involves capital expenditure, and the company cannot raise the necessary capital without the authority of an Act of Parliament, the company may submit to the High Court (or in Scotland the Court of Session), a scheme providing for increasing its loan or share capital; and if the scheme is approved by the Court, then the additional capital shall rank *pari passu* with the existing capital, or with the consent of the shareholders, before it.

17.—(1) Where a generating station, or a main transmission line acquired under this Act, is in the course of construction, extension, or repair, the rights and liabilities of the former owners thereof under contract shall be transferred to the acquiring authority.

(2) Plant which forms an essential part of the distribution system of the former owners of the generating station shall remain the property of such owners.

18.—(1) Where the consent of the Minister of Transport or the Electricity Commissioners would be necessary under the Electricity (Supply) Acts, nothing in this Act shall remove the necessity of obtaining such consent.

(2) Where an application is made by any authorised undertakers to the Minister of Transport or the Electricity Commissioners for their consent, the Minister or Commissioners shall have regard to the provisions of this Act and the effect of any scheme thereunder.

Subsidiary Provisions as to the Board.

19.—(1) The Board shall be deemed to be authorised undertakers within the meaning of the Electricity (Supply) Acts: Provided that sections two and three of the Electric Lighting Act, 1888 (which relate to the purchase of undertakings by local authorities) shall not apply to the undertaking of the Board.

(2) Before any regulations come into force they shall be laid before Parliament for not less than thirty days.

(3) The Board shall not supply electricity directly to persons not being authorised undertakers, except that—

(*a*) They may supply the owners of selected stations, not being authorised undertakers;

(*b*) With the consent of the Electricity Commissioners, they may supply electricity to any company, body, or person requiring a supply for power purposes in any area not forming part of the area of supply of any authorised undertakers, and such supply may be used for lighting premises in which the power is utilised.

20.—(1) The Board may acquire land or any rights in or over land by agreement, or may be authorised to acquire land or any such right compulsorily, for the purpose of any of their powers and duties under this Act (including the construction of main transmission lines) like local authority undertakers under the Electricity (Supply) Acts; and the Board shall be deemed to be a public authority for the purposes of the Acquisition of Land (Assessment of Compensation) Act, 1919.

(2) Nothing in this section shall authorise the compulsory acquisition by the Board of land or rights over land held by the owners or lessees of any railway, canal, inland navigation, dock, or harbour for the purposes of their undertaking otherwise than in accordance with the provisions of the Electricity (Supply) Acts, 1919 and 1922.

21.—The Board may, by agreement, use any main transmission lines for such time and upon such terms as may be agreed.

22.—(1) The Board and any local authority, company, or person producing electricity by water power, waste heat, or otherwise, may enter into arrangements for the purchase by the Board of surplus electricity, and the Board may be authorised by order of the Electricity Commissioners to exercise such powers as may be necessary for the purpose of conveying the electricity so purchased.

(2) The provisions of sub-section (2) of section fifteen of the Electricity (Supply) Act, 1919, shall apply to the Board as to a joint electricity authority.

23.—(1) The Board shall annually make to the Minister of Transport a report of their proceedings under this Act during the preceding year, and such report shall be laid before Parliament.

(2) The Board shall furnish to the Electricity Commissioners such statistics and returns as they may require.

Financial Provisions.

24.—All sums received by the Board shall be paid into a separate fund, out of which the salaries, fees, and allowances of the members of the Board and the salaries, remuneration, pensions and gratuities of the secretary, officers, and servants of the Board, and all expenses incurred by the Board, shall be paid, including repayment to the Electricity Commissioners of any expenses incurred by them in the preparation of schemes under this Act, and payment to the Minister of Transport of any expenses and liabilities incurred by him before the commencement of this Act preliminary to the preparation of such schemes, with interest at the rate of 5 per cent. per annum.

25.—(1) For the purposes hereinafter mentioned the Board may, with the consent of the Electricity Commissioners, and subject to regulations to be made by the Minister of Transport with the approval of the Treasury, borrow money, and the regulations may empower the Board to borrow temporarily and to make arrangements with bankers, and may apply enactments relating to borrowing by local authorities.

(2) Such powers of borrowing may be exercised for—

(*a*) The construction or acquisition of main transmission lines, generating stations, and other works;

(*b*) Any other payment or any permanent work, the cost of which ought, in the opinion of the Electricity Commissioners, to be spread over a term of years;

(*c*) The provision of working capital;

(*d*) Any other purpose authorised under this Act.

(3) Any money borrowed under this section, and the interest thereon, may be charged on the undertaking and all the revenues of the Board, and shall be repaid within such period not exceeding sixty years as the Electricity Commissioners may determine.

(4) The maximum amount which may be borrowed by the Board under this section shall be thirty-three and a half million pounds, and the Board shall not have power to borrow any sums in excess of that amount, otherwise than for the purpose of paying off loans previously raised, unless authorised to do so by a special order under section twenty-six of the Electricity (Supply) Act, 1919.

(5) It shall be lawful for any annual provision for the repayment of borrowed money, to be suspended whilst the expenditure out of such moneys remains unremunerative, subject to such conditions as the Electricity Commissioners, after consultation with the Treasury, may determine:

Provided that such suspension shall not be for a longer period than five years from the commencement of the financial year next after that in which such expenditure is incurred.

(To be concluded.)

The Work of the Electricity Commissioners.

Report for the Year 1925-26. *(Abstract).*

(*Concluded from page* 1096.)

Consents to Subscriptions to Associations.

The Commissioners issued 24 consents in respect of the payment of subscriptions to and/or expenses of attendance at meetings of Associations, and authorised contributions to the expenses of District Joint Industrial Councils.

The British Electrical Development Association made an appeal for increased support, the suggested scale of contributions being at the rate of 20s. per thousand pounds of gross revenue of the electricity undertaking. The Commissioners approved in principle of the new scale, and were prepared to give their consent to the payment of contributions on that basis.

The attention of the Commissioners was drawn to the position of the British Electrical and Allied Industries Research Association Incorporated, the work of which was mainly financed by a contribution from the British Electrical and Allied Manufacturers' Association, and by an equal contribution from the Department of Scientific and Industrial Research; and to the possibility that the financial grant from the Department in question might cease. The work of the Research Association had already proved an asset of considerable value to the electricity supply industry, and the Commissioners informed the Incorporated Municipal Electrical Association that they were prepared to sanction the payment of reasonable subscriptions in that connection. The Commissioners also addressed communications to other representative Associations of the electricity supply industry with the view of enlisting their active support for the work of the Research Association.

Returns and Statistics.

In June, 1926, the Commissioners published a Statistical Return which embodied detailed engineering particulars for the three years 1920-3, and financial particulars for the two years 1921-23 in respect of all authorised electricity undertakings in Great Britain. Progress was made with the preparation of a second Return containing similar particulars for the two years 1923-25 [issued in November, 1926].

During the year the Commissioners received the usual monthly returns of fuel consumption, units generated, &c., in respect of the generating stations (numbering 483) belonging to authorised undertakers in Great Britain, 78 generating stations owned by railway and tramway authorities, and 23 stations owned by non-statutory undertakings.

Transfer of Undertakings.

Under the provisions of 11 Orders, the Commissioners approved of deeds transferring certain undertakings. The transfer of other authorised undertakings also took place during the year. The Corporation of Barnsley acquired part of the undertaking of the Electrical Distribution of Yorkshire, Ltd., and the Corporation of Scarborough acquired the undertaking of the Scarborough Electric Supply Co., Ltd.

By Section 13 of the Act of 1919, it is provided that where any right to purchase the whole or any part of the undertaking of an authorised distributor is vested in a local authority and becomes exercisable before the date of the constitution of a Joint Electricity Authority for the district, the right shall not be exercised without the consent of the Commissioners. During the year the Commissioners received intimations from local authorities in such areas that they had given formal notice of their intention to purchase the electricity undertakings. The legal aspects of the matter were considered, and the Commissioners were advised that their consent under the Section was necessary before the rights of purchase could be exercised; that in the absence of prior consent a formal notice of intention to purchase was not valid; and that a notice given in the absence of prior consent could not be validated by the subsequent issue of a consent under the Section. The local authorities concerned were notified accordingly.

During the year, the Commissioners issued four consents to the exercise by local authorities of their rights of purchase.

Appointment of Electric Inspectors.

During the year, the Commissioners appointed Electric Inspectors for the purposes of the undermentioned Order and Act, and prescribed the fees to be paid for services rendered: (1) Bromley (Kent) Electric Lighting Order, 1891, inspector, Dr. A. Russell; (2) Sheffield Corporation Act, 1918, inspector, Mr. A. E. Moore.

Advisory Committee on Domestic Supplies of Electricity.

In April, 1925, the Commissioners appointed an Advisory Committee to consider what steps could be taken to bring about an increased consumption of electricity for domestic purposes, and also the possibility of simplification and greater uniformity in tariffs and methods of charge adaptable for the object in view. At an early stage of its investigations, the Advisory Committee arrived at certain interim conclusions which were submitted to the Commissioners. Certain of the suggestions put forward by the Committee had already formed the subject of representations made by the Commissioners to the Minister of Transport.

[The Advisory Committee reported in July, 1926, and the Report has been published.]

Charges for Electricity.

The general tendency towards lowering the charges for electricity throughout the country was again reflected in the applications made to the Minister of Transport for Orders authorising a revision of maximum prices. In two cases, the authorised undertakers concerned were taking steps to establish electricity undertakings under Orders obtained in 1914 and 1915 respectively, and it was represented that the maximum prices originally prescribed by the Orders were not sufficient under post-war conditions to ensure a reasonable return on the expenditure incurred. The Commissioners recommended the Minister to grant the desired Orders. In addition, six applications, affecting 10 authorised undertakings, were made for a downward revision of maximum prices; in three cases the Commissioners recommended the Minister to grant Orders, the undertakers having agreed to reductions. In two other cases, where the rights of local authorities to take over the undertakings were approaching maturity, the Commissioners recommended that consideration of the applications should be deferred. In the case of the Twickenham and Teddington Electric Supply Co., Ltd., a joint application was made by all the local authorities concerned. The application formed the subject of a public inquiry, in the course of which the company indicated that the undertaking had reached a stage of development at which it would be prepared to apply the whole of any savings in the cost of working to the reduction of prices to consumers. After consideration of the evidence, the Commissioners recommended the Minister to grant Orders authorising a new maximum price of 9d. per unit and minimum quarterly charges on the usual basis, subject to the company furnishing a definite undertaking on the basis indicated.

Overhead Lines.

There was a substantial increase in the number of applications for consent to the erection of overhead lines, 194 applications being dealt with during the year, as compared with 162 applications during the preceding year. In 84 cases the applications were from local authority undertakers, in 51 cases from electric power companies, and in 59 cases from other company undertakers. The Commissioners were able, in the majority of the cases, to recommend the Minister of Transport to give his consent. In certain cases, however, objection was taken by the local authority to the placing of lines overhead, and the applications in question were referred to the Minister. At March 31st the Minister had given his consent in respect of 189 of the applications, the remaining cases still being under consideration.

During the past two or three years, undertakers have found it necessary in a number of instances to make application for an amending consent to permit of minor deviations from the line of route prescribed in a prior consent. Upon a review of the cases concerned, it appeared to be inexpedient that additional formalities should be invoked where the deviations were of a minor character. After consultation with the Postmaster-General, the Commissioners accordingly recommended the Minister to adopt, in appropriate cases, a modified form of consent, in respect of overhead lines over country of an open character in urban and rural areas, giving power to the undertakers to make minor deviations within certain defined limits if found necessary during the erection of the line. The Minister has since given his consent in the modified form when so advised by the Commissioners. A lateral deviation, even within the defined limit, which would involve the placing of any portion of the line within the district of a local authority other than the one concerned with the original application, would involve a further consent.

Wayleaves.

The Commissioners dealt with 24 applications for consent to wayleaves. In five cases the parties concerned arrived at a settlement. In seventeen cases the Minister of Transport caused local inquiries to be held.

With regard to fifteen cases in which the Minister gave his consent, the wayleave rentals prescribed are given in the Report; examples are as follows:—1s. for each 100 yards of cable laid underground; 1s. for each single pole; 2s. for each double pole; and 6d. for each stay. Where the poles impeded arable farming, 4s. or 5s. was fixed, and 2s. or 2s. 6d. for each pole which impeded the mowing of grass.

Revocation of Powers.

During the year the Commissioners had under review the circumstances in which statutory powers to supply electricity had not been brought into operation. They recommended the Minister of Transport to revoke the Tenby Corporation Electric Lighting Order, 1915; and to defer the question of revoking the Electricity Special Order. An application was made by the Corporation of Gravesend for the revocation of the powers of the Kent Electric Power Company, and the West Kent Electric Company, Ltd., in respect of certain parishes in the Rural Districts of Dartford and Strood. An application was also made by the Urban District Council of Shoreham-by-Sea for the revocation of the powers of the Shoreham and District Electric Lighting and Power Company, Ltd. In each case the Commissioners recommended the Minister not to accede to the application.

Abstraction of Water.

In the case of the application made by the North Metropolitan Electric Power Supply Company for an Order to authorise the abstraction of water from the King George Reservoir of the Metropolitan Water Board, proceedings took place in the High Court, and judgment was given to the effect that the reservoir was "a river, stream, canal, inland navigation or other source" within the meaning of Section 15 (1) of the Act of 1919. The application of the company was under consideration by the Minister at March 31st.

Borrowing Power Regulations.

The Electricity (Supply) Act, 1922, empowers Joint Electricity Authorities to borrow money for purposes specified therein, subject to regulations to be made by the Minister of Transport with the approval of the Treasury. At March 31st the regulations drafted by the Commissioners were under consideration [subsequently issued on August 30th, 1926].

Compensation for Loss of Office, &c.

An arrangement for mutual assistance was entered into by the Corporation of Portsmouth and the Fareham Urban District Council, and approved by the Commissioners. The Council ceased to generate electricity, and arising from the closing down of its generating station, claims for compensation were preferred by four employés. The total amount of the compensation awarded by the Referee was £565 10s.

The Grays Thurrock Urban District Council entered into an agreement for a bulk supply from the County of London Electric Supply Co., Ltd. The Council ceased to generate electricity, and, arising from the closing down of its generating station, claims for compensation were preferred by three employés. The Referee awarded a total sum of £123.

Organisation of the Electricity Commission.

The Commissioners received notice in the early part of the year that it would not be possible for them to continue the tenancy of offices in Gwydyr House. They decided to take the offices formerly occupied by the Metropolitan Water Board at Savoy Court, Strand, and entered into occupation on May 25th, 1925.

During the year the Commissioners found it necessary to make certain additional appointments to their staff to enable the increasing volume of work to be effectively dealt with. On March 31st, 1926, the staff of the Commission numbered 60 in all, and consisted of 30 established officers and 30 unestablished and temporary officers, inclusive of typists and messengers.

At the beginning of the financial year the Commissioners estimated the net cost of administration for the year at £54,700; after allowing for a reduction of £1,700 in the working balance, the total amount to be apportioned among authorised undertakers was £53,000. The certified returns submitted to the Commissioners showed that 4,997,963,253 units were sold by authorised undertakers in Great Britain during the year ended December 31st, 1924. The apportionments in June, 1925, the contributions by the electricity supply industry towards the expenses of the Commissioners for 1925-26 thus involving a payment by each authorised undertaker concerned amounting to about 2.54d. per 1,000 units sold.

The actual excess of expenditure over receipts was £44,098, and the working balance was increased by £8,901. The expenditure included £3,731 for a further report on the standardisation of frequency, and the work of Advisory Committees.

Returns submitted to the Commissioners showed that the "units of electricity sold" by all authorised undertakers during the year ended December 31st, 1925, amounted to 5,515,345,364, an increase of over 10 per cent. as compared with the preceding year; the estimate of expenses for the year 1926-27 approved by the Minister of Transport amounted to £51,000, and apportionments involving a payment of 2.23d. per 1,000 units "sold" were made on authorised undertakers in July, 1926.

The Commissioners record with regret the resignation, on June 30th, 1925, of their colleague, Mr. Archibald Page, from the office of Electricity Commissioner after more than five years of service in that capacity, to take up an appointment with the County of London Electric Supply Co., Ltd. Consequent upon this resignation, the Minister of Transport appointed Mr. S. L. Pearce, C.B.E., consulting and chief engineer and general manager of the Manchester Corporation Electricity Department, to the office of Electricity Commissioner.

Attached to the Report are 17 appendices, containing reports relating to eight Districts, details of consents to extensions of plant and to main transmission lines, lists of Special Orders applied for and made, and particulars of loans sanctioned, systems of supply, non-statutory undertakings, fringe orders, proceedings under the Trade Facilities Acts, and the Electricity Fund Account.

Electrical Development in Belgium.

THE Belgian National Commission on Production, which has just issued its final report, deals at length with the situation of the coal industry, the fuel problem and the economies to be realised, and the production and distribution of electricity. At the outset it is pointed out that the distribution of electricity permits of the concentration of production in large stations, the capital costs of which are low, and allows, moreover, of the use of coal which is otherwise unsaleable, and of the low-quality gas yielded by coke ovens and blast furnaces.

An example of what ought to be done, it is said, is afforded by the industrialists in the region of Liége, whose generating stations are interconnected and interchange the available energy, saving in this manner 60,000 tons of coal per annum. Similar organisations are in the course of being realised or are projected elsewhere. The interconnection of such networks will constitute further progress. But in order to allow of this parallel working of the generating stations throughout the country, it is necessary for the voltages and frequencies to be standardised and for the construction of main transmission lines to be undertaken.

Under the circumstances the Commission, addressing itself both to the public authorities and to industrialists, has reached the following conclusions:—(1) That the supply of cheap electrical energy is a matter of national interest; (2) That the economical production of electricity requires the maximum utilisation of energy obtained from by-products, the use of generating units of high power, the rational use of engines of different kinds, and the smallest installation of reserve plant which is not fully utilised; (3) That the organisation of groups of large stations, uniting the industrial stations fed by blast-furnace gas, coke-oven gas, and refuse fuel, at the same time as the central stations consume coal, is capable of ensuring the achievement of these objects and of bringing about a minimum consumption of fuel and a maximum of reliability; (4) That the results obtained in this sense by the Union des Centrales Electriques grouping the several generating stations in the basin of Liége, fully confirm the theoretical calculations which it is possible to make on this subject; (5) That various schemes have recently been prepared with a view to utilising sources of hydraulic energy; (6) That the general organisation of the production of electricity in Belgium, based upon the creation or development on a more or less extended scale of large central stations, as well as the running of the generating plant in parallel, would permit of the reduction of the annual consumption of fuel, as well as of the cost of labour, by at least 50 per cent. of their present amount for the whole of the generating stations. The Commission consequently recommends the development of efforts in these directions.

Concerning the utilisation of waterfalls, the Commission states that Belgium is not well provided with natural waterpower. It is not even certain that it would be possible to create artificial waterfalls with a good yield by the construction of dams so as to form reservoirs in the valleys situated in the Ardennes, or to harness the rivers. But if hydraulic installations considered exclusively as sources of electrical energy are not economical, they would be able to become so if they were utilised not only for the production of energy, but also for regulating the discharge of rivers and diminishing the effects of inundations, remedying the pollution of rivers, feeding the navigation canals, ensuring the navigability of rivers, and placing water at the disposal of industrial regions. Taking these matters into consideration and bearing in mind that projects have been prepared for the construction of large barrages in the Ardennes and for the regulation of certain watercourses, the Commission suggests that the Government should cause a general study to be made from the technical, economic, and financial standpoints of a part of the schemes for barrage reservoirs proposed for the Ardennes on the one hand, and the schemes for the organisation of the Meuse between Liége and Visé on the other.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

ABERDEEN.—1,000 houses, for Corporation; city architect.

ALLOA.—Motor engineering works; Wilson & Carmichael, solicitors.

AUCKLAND (NEW ZEALAND).—Development of a civic centre in Queen Street: Art Gallery, Town Hall Annexe, and other buildings, first instalment (£630,000), subsequent developments, £383,000; the City Council.

AUSTRALIA (MELBOURNE).—Installation of pneumatic tube service for the Commonwealth Postmaster-General. Supply Officer, Australia House, Strand, W.C.

AUSTRALIA (SYDNEY).—Rebuilding premises, for Messrs. Metters, stove and windmill makers (£135,000).

AYLESBURY.—Additional 60 houses, for the R.D.C.; surveyor.

AYR.—Ultra-violet treatment to be introduced at Heathfield Hospital; medical superintendent.

BAKEWELL.—Electric light installation, Haddon Joint Hospital; Charles Flint, architect, The Quadrant, Buxton.

BANDON (Co. CORK).—Cottage hospital for South Cork County Board of Public Assistance; D. Egan, secretary, County Home, Douglas Road, Cork.

BATLEY.—Extensions to Providence Street schools (£12,100), for the borough E.C.; the clerk.

BILLINGHAM.—Houses, for the U.D.C.; builders, J. G. Porteous, Ltd., Middlesbrough (52), T. Sweeting, Middlesbrough (52), J. McCreton, Ltd., North Ormesby (56), and G. Fordy, Stockton-on-Tees (56).

BIRKENSHAW (YORKSHIRE).—Elementary school; West Riding Education Department, County Hall, Wakefield.

BOMBAY.—Market, Dador Colony; municipal commissioner.

BO'NESS.—Extensions for Seaforth hosiery factory; J. Taylor, architect.

BRADFORD.—186 houses for Corporation, at Eccleshill No. 6 estate; city architect, Town Hall, Bradford (Jan. 11th). 340 houses for Corporation, at Wyke; city architect, Town Hall. Extensions to the Northbrook Brewery, for J. Hey & Co., Ltd.; W. Illingworth, architect, Sunbridge Road.

BRETBY.—Extensions to Bretby Hall tuberculosis institution and administrative quarters, for Derbyshire C.C.; Mr. Widdows, county architect, Derby.

CAMBRIDGE.—Ward, Fulbourn Mental Hospital; A. Paul Macalister, architect, 20, St. Andrew's Street.

CAPE TOWN.—Market extensions (£50,000); municipal engineer.

CREWE.—Additional housing scheme (150), for the T.C.; E. G. Timbrell, architect, Municipal Buildings.

CROYDON.—Additional 50 houses, Coulsdon, for the T.C.; Borough Engineer.

DAGENHAM.—School, March Green (£8,315), for Essex E.C.; J. Stuart, county architect, Springfield Old Court, Chelmsford.

DUMFRIES.—Water supply scheme (£101,345), for the Dumfries and Maxwelltown Water Commission; the clerk.

DUNDEE.—U.F. Church; Rev. J. Robbie, clerk of Presbytery. Western Esplanade extension (£70,000), extension of Dudhope Terrace (£10,000); city engineer. School for education authority in Perth Road; the clerk.

EASTLEIGH (HANTS.).—Houses (56), Stanley Road, for T. W. White, 111, Nutbeem Road.

GLASGOW.—53 houses at Netherlea (electric light); Mitchell and Sons, builders. 112 houses, Shettleston; housing director. 192 houses, Germiston; Brown, Fraser & Co. 2,000 Corporation houses at Carntyne; Director of Housing, City Chambers. 182 houses at Kelvinside; Mactaggart & Mickel, Ltd., 65, Bath Street. Scottish National Commercial College (£100,000); clerk, education authority. Kinema, Springburn; B. Frutin, 164, Argyll Street. Additions and alterations to Stobhill General Hospital, clerk, Parish Council.

GRAVESEND.—Schools, Whitehill Road (£10,840), for the E.C.; Friday & Sons, builders, Erith.

GRIMSBY.—Maternity home, Nunsthorpe; Steele & Goddard. 60 houses, Nunsthorpe; borough engineer.

GUILDFORD.—'Bus garage; L.G.O.C.

HEMSWORTH (YORKS.).—Housing scheme (40), Grove Lane, for the U.D.C.; surveyor.

HORBURY (YORKS.).—Blanket mills, Coxley Valley, Middlestown, for Messrs. Clayton.

HOVE.—100 houses, Knoll Housing Estate, Old Shoreham Road; borough architect.

KILMARNOCK.—Additional housing scheme (210), for the T.C.; borough surveyor.

LEICESTER.—Extensions to the Municipal College of Technology (£50,000).

LEITH.—Secondary school; clerk, Education Authority, Edinburgh. Public library; city architect, Edinburgh.

LONDON (BARKING E.).—160 houses, Cecil Estate; C. Gray. Electricity offices and showrooms, Ripple Road, for the U.D.C.; council architect.

(BARKING TOWN, E.).—32 houses, River Road; County of London Electric Supply Co., Ltd.

(E.C.).—Block of offices, St. Mary Axe; W. D. Caroe, architect, 3, St. College Street, S.W.1.

(MUSWELL HILL, N.).—Bank, shop and flats, Broadway; E. Maufe, 3, Raymond Buildings, W.C.1.

(CRICKLEWOOD, N.W.).—Factory, Oxgate Lane; E. Brown and Son, Ltd.

(HAMPSTEAD, N.W.).—Extensions, Westfield College for Women Students, Kidderpore Avenue; Thompson and Walford, architects, Leadenhall Street, E.C.

(REGENT'S PARK, N.W.).—Additions to Bedford College for Women; Sir J. W. Simpson and M. Ayrton, architects, 3, Verulam Buildings, Gray's Inn, W.C.

(WILLESDEN, N.W.).—1,400 houses, Walles Hill; Costain and Sons, Ltd.

(BRIXTON, S.W.3).—Stores, corner of Brixton Road and Stockwell Road, for Bon Marché, Ltd.; H. P. Wyatt, architect, 465, Brixton Road, S.W.

(CLAPHAM COMMON, S.W.).—Enlargement and rebuilding senior school, for the Governors, Royal Masonic Institute for Girls; A. B. Brown, Freemasons' Hall, Great Queen Street, W.C.2.

(LEICESTER SQUARE, W.).—Drapery emporium, corner of Leicester Square and Wardour Street; Whinney, Son and Austen Hall, 8, Old Jewry, E.C.

(PARK LANE, W.).—Block of flats on Grosvenor House site; Wimperis, Simpson & Guthrie, 61, South Molton Street, W.1.

(RED LION SQUARE, W.C.).—Premises to be called Conway Hall, for the South Place Ethical Society, South Place Institute, Moorgate, E.C.2.

MAIDSTONE.—Houses (118), for the T.C.; Corben & Sons, builders.

MALDON.—50 houses, Cross Road and Mundon Road, borough engineer.

MANCHESTER.—Rebuilding Winter Gardens Kinema, Peter Street; proprietors. Block of offices, 40, Cannon Street (£200,000); proprietors.

MIDDLESBROUGH.—Additional 100 houses, for the T.C.; borough surveyor.

RHYL.—Central school; Flintshire Education Committee.

RUGBY.—Additional 32 houses, for the R.D.C.; surveyor.

RUTHERGLEN.—Church, hall and offices at Burnside; convener, Home Mission Committee, Glasgow Presbytery.

SALFORD.—Schools, Tootal Drive, Weaste, for the borough E.C.; the clerk.

SHEFFIELD.—Development of Wey Manor Estate, New Haw (3,600 houses); G. Longden & Son.

SHIPLEY (YORKS.).—68 houses, Albert Road estate; H. Dawson, architect, Council Offices, Somerset House.

SITTINGBOURNE.—Stores (£7,936), for the Co-operative Society; E. Bishop & Sons, Ltd., builders.

SOUTHEND-ON-SEA.—Intermediate school (£24,500), for the borough E.C.; the clerk.

SOUTHERN RAILWAY.—£8,000,000 extension scheme (Southampton Docks extension, £3,000,000; new stations at Eastbourne and Epsom; cleaning sheds at Victoria, &c.).

STOCKBRIDGE (YORKS.).—School; Education Department, West Riding County Hall, Wakefield.

SWANSCOMBE (KENT).—Housing scheme (48), Milton Road site, for the U.D.C.; surveyor.

TONBRIDGE.—Public hall kinema, for Mr. Beaden.

TORQUAY.—Reinstatement of "Courtlands," Chelston, for F. Dobson, C.C. (£4,000).

UPMINSTER (ESSEX).—Roman Catholic Church and schools (£7,000); Rev. Father M. J. Healy.

WALLINGFORD.—Hospital (£8,500), for the committee; the secretary.

WALSALL.—182 houses; Richards, Smith & Co., Ltd.

WALTHAM ABBEY (HERTS.).—Development of Hayes Hill estate, with 250 houses; Bristow & Co., architects.

WATH-UPON-DEARNE.—Secondary schools (£11,050), for West Riding E.C. director of education, County Hall, Wakefield.

YORK.—42 Corporation houses, Tang Hall Estate, No. 2; F. W. Spurr, city engineer, Guildhall (January 17th).